Decoding the journey: An in-depth analysis of the frontline impacts of the introduction of the short course in Coding: A case study of two Irish schools.

UNA FLEMING

A thesis submitted to the University of Limerick in fulfilment of the requirements for a Masters by Research in Education.

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Authors Declaration

I hereby certify that this material, which I now submit for assessment, is entirely my own work and has not been taken from the work of others, save to the extent that such work has been cited and acknowledged within the text of my work.

I further declare that this thesis has not previously been submitted as an exercise for a degree at the University of Limerick or any other Institution or University.

Signed:  Date: 17th November 2020

Ms Una Fleming

Abstract

Computer Science Education (CSE) has risen in popularity around the world, with advances in both the quantity and content of CSE programmes. These changes have been emulated in the Republic of Ireland (ROI), where CSE, has been formally introduced at both lower and upper-second-level education. At lower-second-level, the CSE course was titled Coding. This course established for the first time an optional curricular component, which enabled students to receive certification within the area of CSE. The course was first piloted in twenty-two schools in January of 2016 and has seen a steady uptake in number since.

This study provides a unique insight into the lived experiences of teachers and students after the introduction of Coding within their schools. Data was collected through semi-structured teacher interviews with four teachers, student surveys with sixty students, classroom observations and school document analysis. This study provides a snapshot of Coding within two schools; the fundamental findings were:

- Initially, a school culture of adaptability was a critical factor in the inclusion of Coding within the school timetable.
- Individual educators with a passion for CSE were the continued drivers of the program in both schools.
- For the majority of students, prior experiences of CSE were pivotal in their desire to pursue further study in the area.
- Finally, 95% of students enjoyed one or more aspects of the Coding short course.

The information and observations gathered within this dissertation will be of interest to all those who seek to understand CSE enactment in a case-specific context within the ROI.

Ethics Approval

The research for this thesis received the approval of the Faculty of Education and Health Sciences (EHS) Research Ethics at the University of Limerick.

EHS Research Ethics Committee Number: 2019_05_14_ EHS

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Table of Contents

List of Figure

List of Tables

List of Abbreviations and Acronyms

ACM	Association for Computing Machinery
CPD	Continuing Professional Development
CSE	Computer Science Education
CSO	Central Statistics Office of Ireland
DEIS	Delivering Equality of Opportunity in Schools
Epi*Stem	National Centre for STEM Education at the University of Limerick
ETB	Education and Training Board
HEA	Higher Education Authority
ICT	Information and Communication Technologies
JCCiA	Junior Cycle Coding in Action
JCSA	Junior Cycle Student Award
JCT	Junior Cycle for Teachers
NCCA	National Council for Curriculum and Assessment
NFQ	National Framework of Qualifications
OECD	Organization for Economic Co-operation and Development
ROI	Republic of Ireland
SCP	School Completion Programme
SFI	Science Foundation Ireland
STEM	Science, Technology, Engineering, and Mathematics
UK	United Kingdom (England, Scotland, Wales and Northern Ireland)

Chapter 1 Introduction

This study sought to document teachers' and students' lived experience in post-primary schools, following the introduction of the Coding short course in the Republic of Ireland (ROI). Each of the schools involved in the study elected to alter their school timetable to include Coding at lower-second-level. The primary aim of the Coding short course was to allow students to learn about Computer Science. Webster 1996, outlined that Computer Science 'includes not only the machines as artefacts but also the expertise and knowledge, culture and values of the computing profession, as well as… the production of hardware and software' (p.9). The above definition of Computer Science is utilised to cover all aspects of Computer Science Education (CSE), including Coding as a subject area within this dissertation. An expanded discussion of the scope of the Coding short course can be found in Chapter two. Chapter one focuses on providing a concise summary of the research project, including the background, aims and research questions, investigation methods, and dissertation structure.

1. 1. Background of the Study

In 2016, the government of the ROI altered its approach to CSE with the introduction of a dedicated short course in Coding at lower-second-level. This initiative was aimed at students aged between twelve and fifteen. Following the introduction, schools were equipped with a shared map for CSE at lower-second-level (Connolly, 2018). Heretofore they had acted as individuals within their schools; now they possessed a shared curriculum (Ireland. Department of Education & Skills, 2016). Despite the opportunities, which this change presented, according to Goodlad (1988), curriculum developments 'rarely follow the rhetoric of change proposed in policy documents', and so research needs to be carried out on the frontlines to uncover what is happening within schools (p.14).

To date, over one hundred and thirty schools have engaged in three government initiatives designed to support the introduction and inclusion of Coding in schools. The first year-long initiative was called Exploring Coding; it supported twenty-two schools and lasted from January 2016 to January 2017. The second

initiative began in September 2017, known as the Junior Cycle Coding in Action (JCCiA); it supported fifty-two schools and ended in May 2019. From September 2019 to May 2021, the final initiative was referred to as JCCiA Phase II; it saw numbers of participating schools expand to sixty. Each of these initiatives sought to affect the practice and day-to-day experiences of teachers and students. However, research on the topic has been limited, primarily focused on capturing and discussing developments from a top-down perspective. Case studies are one way of understanding and documenting change from a bottom-up perspective (Baldwin & Apelgren, 2015). This method allows researchers to capture' data which can often be context-sensitive or complex (Bassey, 1999). Prior to the construction of this study, there was limited access to operational details as well as the first-hand experiences of teachers and students as they adapt to the inclusion of Coding. Ozga (2000) asserts that to understand change research is both 'urgent and necessary' (p.1). With this in mind, this researcher began to design this study and the research aims, found below, began to take shape.

1. 2 Research Aims

The author of this research study examined how Coding's introduction, a recent educational reform in the ROI, has been enacted by conducting a case study of two schools. Taylor and Cranton (2013) proposed that there are too few studies of this kind carried out during the period of transformative learning; these are studies that are carried out during change. Also, it hopes to avoid the generalisation or inaccuracies of a large-scale survey of CSE in Ireland. This research aims to:

- Uncover what is happening on the frontline of Coding within each of the two case schools.
- Document the perceptions of students and teachers to the short course in Coding.
- Capture tacit data by reviewing school documents and observing schools in operation.

1. 3 Research Questions

The research questions are probing in nature and designed to understand how Coding's introduction has affected students and teachers in each case school. The research questions that guided the research process are as follows:

1. What are teachers' perceptions and experiences of implementing the Coding short course?

2. What are students' perceptions and experiences of learning in the Coding short course?
3. How is the Coding short course being implemented in the two case study schools?
4. What similarities and differences are observed between the two case study schools, and what can be learned from this comparison?

It is hoped that answering these questions will provide an insight into the impact of the reforms within the two case study schools and uncover what is happening on the frontline of CSE at lower-second-level in these selected schools.

1. 4 Focus and Scope of the Study

This study's key focus is Coding at lower-second-level in the ROI, as outlined in the specification of the Junior Cycle short course in Coding as 'a separate subject distinct from the use of computers to support learning in other areas of the curriculum' (Finn, 2016). The short course 'has its curriculum documents defining what students will know, the skills they will master, and the attitudes they will acquire' (Fluck, Webb, Cox, Angeli, Malyn-Smith, Voogt, & Zagami, 2016, p. 39). It should be noted that some schools were offering school-based Information and Communication Technology (ICT) or other technology programmes to students before the introduction of Coding; these were predominantly focused on the use of technology and were not recognised at a national level. The scope of this research has been limited in two ways:

1. The ***context*** is limited to the two schools, four teachers and sixty students involved in the study and does not wish to give general contextual findings. However, were needed the researcher has noted wider contextual developments within the area of CSE, particularly its developments and underpinnings with the Irish specific context.
2. The ***time*** is from the introduction of reforms to CSE at lower-second level from 2016 to the spring of 2020. Research data was gathered from the spring to autumn of 2019.

It is hoped that this research study will document how the short course in Coding has influenced students and teachers within each of the case schools.

1. 5 Need for the Study

This research was motivated by a desire to understand teachers' and students' lived experiences of the Coding short course. It was inspired by the writings of Thomson and Hall (2016) who state that researchers and policy-makers, to avoid referring to 'the school' as if it were a generic institution (p. 8-9). This generalised focus has been one of the prevailing limitations of the current discourse surrounding the integration of Coding. While reports like the ones produced by McInerney, Carey & Power, 2018; Fleming & McInerney, 2019; Fleming & McInerney, 2020, provide critical statical data, they focus on the 'general picture' or the state of Coding. Thomson & Hall (2016) cautions that this type of authorship simplifies schools and leaves them open to 'the archetypical or stereotypical imaginings' of the reader (p.8-9). To avoid this, the researcher decided to catalogue the unique and singular impacts of Coding on individual schools. Taylor and Cranton (2013) argued it is necessary to 'observe policies in action, tracing how economic and social forces, institutions, people and interests, events and chance interact' with the policy as it is put into practice (p. 20). In accordance with the above recommendations, two schools were selected so that communities and differences could be tracked. This dissertation provides a snapshot of each school experience of introducing Coding short course, documenting their journeys towards integrating Coding. This research is valuable for those who seek to understand the impact of introducing Coding short to students and teachers.

1. 6 Research Methodology

In order to fulfil the research aims and provide clear documentation of the frontline impacts of the introduction of the short course in Coding, a case study methodology was employed. The case study framework, which underpins this study, was developed by carefully considering each school's nuances. Data was gathered from various sources in order to capture a variety of perspectives (Table 6). The quantitative data was gathered from a student survey (n=60), school inspection reports, and an onsite visit. The qualitative data was obtained from conducting semi-structured interviews with teachers (n-4), classroom observations and open-ended questions within the student survey. Throughout the study, the author was careful to ensure that the information gathered was reliable and valid. Further details around the limitations, ethical considerations and the research framework can be found in Chapter Four.

1. 7 Dissertation Structure

This dissertation's design is in line with the guidelines set out in the University of Limerick, Postgraduate Handbook (2016). It has seven chapters, each of which will build, support, and attempt to answer the research questions. The titles of these chapters are as follows:

- Introduction (Chapter 1) outlines the background to the research undertaken, the reason the research was conducted, its significance and scope.
- Research in Context (Chapter 2) is dedicated to describing the context of the research. It contains crucial contextual information around the international, national and regional.
- Literature Review (Chapter 3) provides an insight into the emerging corpus of academic literature relevant to this research study.
- Methodology (Chapter 4) outlines the methodology employed throughout this research study; it will locate the study ontologically and provide details of the specific research approach adopted and justify its methodology. The reliability and validity of the design will also be discussed.
- Research Findings (Chapter 5) presents the case study findings; it discusses the study's qualitative and quantitative results.
- Discussion of Findings (Chapter 6) summarises the issues raised in the discussion and generally draws findings together, by drawing upon Donna Kerr's research (1976). It outlines what can be learned from the study. It raises questions and highlights issues arising from the research, which may need to be considered and examined within further research studies.
- Conclusions (Chapter 7) the dissertation will conclude with an overview of what this study can tell us about introducing Coding into each case study school.

Each section within this dissertation was designed to be comprehensive without being overly taxing to read within this complex and ever-expanding field of research.

Chapter 2 Research in Context

This chapter provides an overview of the context in which this study was conducted and is divided into three sections which explore the research context through an international, national and local lens.

2. 1 International Rise in Computer Science

CSE is a rapidly expanding area of research and development. However, it is often difficult for researchers to navigate, due to the variance in name, structure and content of CSE courses at lower-second-level around the world. Some alternatives names used are Informatics, Computing, Computer Studies, Programming, Coding and Digital Technologies. As noted by Fluck et al. (2016) 'not all of these cover the same ground, but there are a number of commonality between these courses of study' (p.39). In addition, while most countries have CSE aspirations in terms of government statements, only a few countries have clear policies in this area. An overview of the research context will be explored within this chapter, while in chapter three; there will be a closer examination of the literature surrounding CSE.

2. 1. 1 Mapping CSE

Over the last five years, there has been an expansion in the number of countries with CSE as a part of their formal curricula most notably in New Zealand, France and Finland (Bell, Andreae, & Robins 2014). Other countries, such as Israel, the United Kingdom (UK) and India have had a much longer and complex CSE history at second-level (Hubwieser, 2013). A considerable number of countries are yet to introduce formal CSE programmes at this level; generally, these countries rely on third-level institutions or volunteer-led outreach to inform and attract students to Computer Science (Bell et al., 2014). It should be noted that the extent to which national educational systems are decentralised have a substantial impact on policy development and educational practice. Many countries have decentralised systems, most notably Russia (Bosova, 2019), the United States (Wang, Hong, Ravitz, & Hejazi Moghadam, 2016), and India (Raman, Venkatasubramanian, Achuthan, & Nedungadi, 2015), Canada, Australia. These governments have made commitments to incorporating CSE as a core element of their countries' education system. However, it is essential to note that there is a great deal of variance within these policies' regional introductions. In contrast,

Slovenia, Latvia, Ireland, New Zealand, Denmark, and the Netherlands have centralised education governance. Each of these countries are adapting their education policy to include CSE at lower-second-level (Fluck et al., 2016, p. 43).

As part of this research project, a map on the current state of CSE implementation around the world was constructed; this map can be seen in Figure 1. The dark green countries on the map have policies that state that CSE is a core component of national education. The mid-green regions have CSE policies, that are optional or elements of core educational curriculum, within the lightest green countries, no policy could be found.

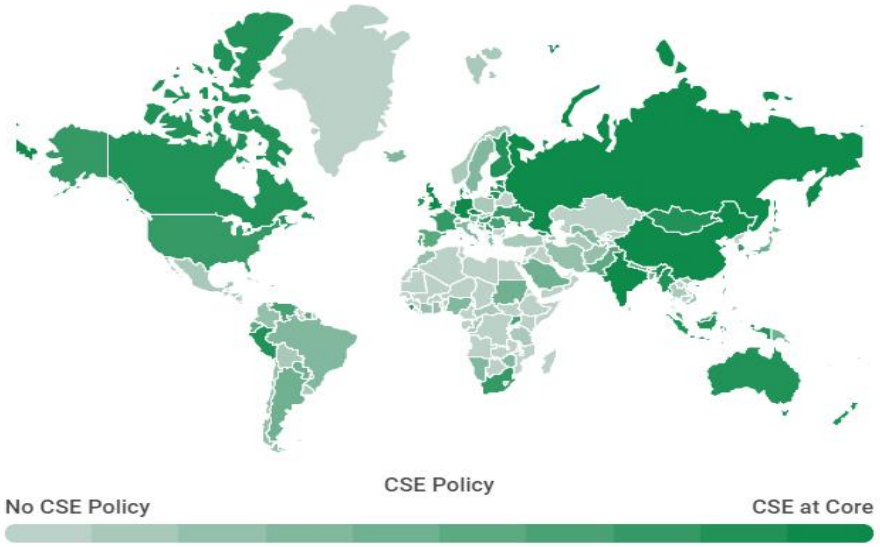

Figure 1 Global picture of Computer Science Education at lower-second-level

2. 1. 2 Drivers' of CSE Expansion

The motivations behind the introduction of CSE can be as complex as the naming structures. However, there is a great deal of commonality between countries (Falkner and Vivian, 2015). The most commonly utilised reasons for including CSE at lower-second-level are as follows:

1. Decreasing the 'new digital divide', according to the Organization for Economic Co-operation and Development (OECD), the first digital divide, access to digital devices, is over within OECD countries (2003). The 'new digital divide' refers to a student's ability to use technology to create, connect with others and develop skills in a digital setting (Vincent-Lancrin, Jacotin, Urgel, Kar & González-Sancho, 2017).

2. Expanding student's skills (problem-solving, critical thinking, computational thinking, etc.).
3. Increasing the numbers of students exiting second-level education with the ability to utilise technology.
4. Strengthening a countries economic position, as the world economy moves away from traditional industries towards an increasingly digital and paperless economy.

As the above list indicates, the justification and motivation behind the introduction of CSE are often focused on prestige within the system, skill acquisition, and satisfying socio-economic industry influences. To fulfil the above requirements, many countries have incorporated CSE into their lower-second level curriculum. There have been movements away from traditional 'use of technology' programmes, towards programmes which are '…not necessarily tied to technology…' but focused on developing skills and understanding within the area of programming and computational thinking (Guzdial & DuBoulay, 2019, p.11). These arguments will be discussed in further detail in Chapter 3.

2. 2 Irish Educational Context

Ireland has followed these international trends and has seen a move away from 'use' towards 'skill' developments in CSE. The ROI has a centralised education system; this facilitates the speedy introduction of innovations in education (Vincent-Lancrin et al., 2017). Schooling is generally divided into eight years of primary education, and six years of second-level education (approx. 12-18 years of age), often referred to as post-primary. Second-level education is divided into two cycles, lower-second-level education referred to as the Junior Cycle and upper-second-level referred to as Senior Cycle (Ireland. Department of Education and Science, 2004). Students can select from a range of subjects at both levels, some of these are compulsory, others are optional. At the end of each cycle, state-level examinations provide certification and are recognised at level three and five of the National Framework of Qualifications(NFQ), respectively (NFQ, 2020).

Initial movements towards introducing computers within post-primary education were strongly supported by the government, teachers and third-level institutions (Ireland. National Council for Curriculum and Assessment (NCCA), 2001). However, momentum quickly dwindled, and the movement was subsequently led by enthusiasts, who often operated within-subject silos (Leahy & Dolan, 2016, p.138). Indeed, what emerged through the 1980s was a system that focused on the use and understanding computers

within other subject areas, such as the introduction of an optional computer studies module to the Senior Cycle mathematics syllabus in 1980. This was followed by the reference to computers within the Senior Cycle Technical Drawing and Physics syllabus (Ireland. NCCA, 2001, p.120). In 1985, there was an attempt to introduce a Computer Studies syllabus at lower-second-level. However, there was no formal examination and no evidence of its uptake within schools (Quille, Faherty, Bergin, & Becker, 2018). Despite numerous attempts to introduce computing to students in the ROI, the number of second-level schools and students with access to training, devices, and other resources severely limited the scope of CSE through the 1980s and 1990s (Ireland. NCCA, 2001, p.124). In fact, it was not until the mid-1990s that the Department of Education provided each school with a Gateway computer (Leahy & Dolan, 2016, p.138). In the early 2000's, there was a renewed interest in ICT, with the decade referred to as IT2000 by the Department of Education and Skills. This decade saw an expansion in the use and availability of computers within schools.

In 2013, the Minister for Education and Skills, Ruairí Quinn, launched the Junior Cycle Student Award (JCSA). The JCSA has been described as the 'reformed Junior Cycle', as it marked a substantial move away from the established educational structure towards an adopted model, which allowed for flexibility in terms of content, delivery, and examination (Connolly, 2018). As part of this reform, schools were given autonomy to incorporate 'short courses' into their existing timetables. In 2016, following international trends and local support, two new short courses were introduced in Coding and Digital Media Literacy. While at upper-second-level, a dedicated optional subject Computer Science was developed by the Professional Development Service for Teachers (PDST) in 2018. The introduction of these reforms meant that for the first-time students were given an option to study computing across all five years of their formal second-level education (Quille et al.,2018). Identifying the importance of CSE in lower second levels, Ireland has introduced Coding at lower-second level. This dissertation will look solely upon reforms related to the Coding short course and will not look in further detail at upper-second-level, nor will it focus on Digital Media Literacy, which primarily focuses on using digital tools.

Baldwin and Apelgren (2015) argue that policy changes under the Common European Framework have also aided the incorporation of CSE within many European Union countries. There were several

constraints to the adoption of CSE, most notably: a lack of cohesive CSE policy, funding, or standards for this area of learning, meant disillusionment and disconformity defined early steps towards CSE adoption within the post-primary context (Leahy & Dolan, 2016, p. 170-171). Despite prospects and demands of CSE, counter-arguments by Hubwieser, Giannakos, Berges, Brinda, Diethelm, Magenheim, Pal, Jackova, & Jasute (2015) present that higher dropout rates and little information towards influencing individuals to follow a Computer Science career surpass the benefits of CSE. The statics released by the Higher Education Authority (HEA) of the ROI, revealed that (16-20) % of students in Ireland starting a Computer Science degree course tend to quit without obtaining a degree (see Figure 2).

FIELD OF STUDY	2007/08-2008/09	2010/11-2011/12	2011/12-2012/13	2012/13-2013/14	2013/14-2014/15
Education	5%	3%	3%	5%	4%
Healthcare	10%	7%	8%	8%	8%
Combined & Other Disciplines	12%	12%	11%	-	-
Social Science, Business and Law & Arts and Humanities	10%	11%	12%	13%	13%
Science, Agriculture & Veterinary	12%	10%	11%	11%	11%
Engineering (excl Civil)	9%	12%	12%	13%	13%
Construction and Related	16%	17%	19%	19%	20%
Services	15%	22%	19%	20%	16%
Computer Science	20%	19%	18%	20%	16%
All Fields of Study	***11%***	***11%***	***11%***	***12%***	***12%***

Figure 2 CSE drop-out rates in Ireland (Source: HEA, *2017, p.34)*

The above figures indicate a lack of understanding of the study of computers among students. In 2014, Ireland also experienced policy changes. Bell et al., 2014, cautions that previously, the available qualifications were not suitable and advised to avoid computing at schools that promoted wrong impressions of CS within a curriculum. Therefore, it is vital that if policies are introduced, both course content and the skill/ knowledge level of teachers are considered.

2. 2. 1 What are Short Courses?

A short course is an optional curriculum component, designed for approximately one-hundred hours of delivery in each year of study at lower-second level. Short courses represent an innovative, creative and

optional curriculum component within the Framework for Junior Cycle. Short courses can be designed by independent agencies, schools or even teachers as long as they adhered to the guidelines outlined by the NCCA (Ireland. Department of Education and Skills, 2014). In 2014, the NCCA developed ten short courses. While most schools choose to offer various short courses, they are often categorised within the following interest streams, as seen in Figure 3. These short courses paved the way for an expansive list of the optional short course, which schools can design, adapt and elect to include in their timetable.

Figure 3 Sample of Irish Short Courses

2. 2. 2 The Short Course in Coding

Coding is an optional curricular component for schools, designed in consultation with industry and academia, to be flexible and fit into the school timetable. The Junior Cycle short course titled Coding was designed to be followed chronologically through strands 1-3. The first strand focuses on introducing students to computers (both hardware and software). In contrast, the second and third strands relate to skill development and knowledge acquisition within Coding areas, moving from Stretch to Python (Ireland. NCCA, 2014). The Irish government has attempted to address these concerns by providing support in funding for equipment and continuing professional development (CPD) programmes. Figure 4 outlines, the government supports for the

short course from when it was first piloted in twenty-two schools in 2016 to its final phase of supports which commenced in September of 2019.

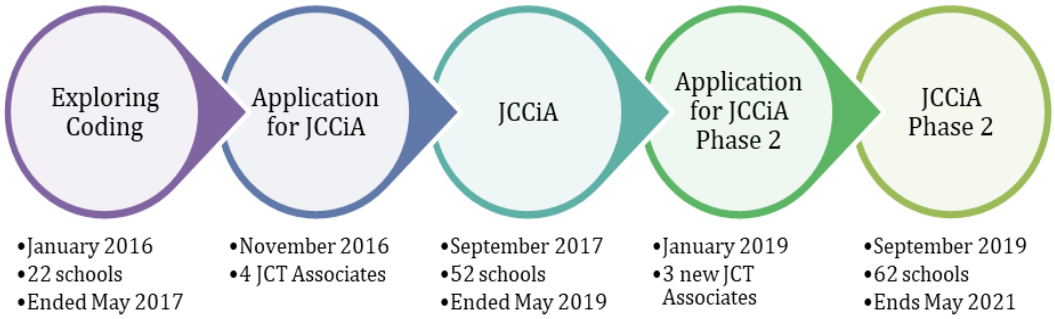

Figure 4 Overview of JCT initiatives which have supported the Coding short course

2. 3 School Level Context

Many aspects of the ROI education system administration are centralised in the Department of Education and Skills. The Department of Education and Skills sets the general regulations for recognising schools, prescribes curricula, establishes regulations; and controls the allocation of resourcing and staffing. In general, the Principal is responsible for the school's day-to-day management, including the school's teachers and other staff's guidance and direction. The principal is accountable to the Board of Management or Education and Training Board (ETB). They oversee services as well as budgets of schools.

The Irish government provided support to schools in the form of funding for equipment (Digital schools initiative) and professional development programmes provided by the Junior Cycle for Teachers (JCT). From 2016-2020, a variety of supports were provided by the JCT to support schools who wished to include the short course in Coding in their timetable. These supports were offered within three successive initiatives of CPD, Exploring Coding, Junior Cycle Coding in Action Phase I and II. On-site training days and school visits supported each of the initiatives. Figure 5 showcases the full range of supports offered by the JCT.

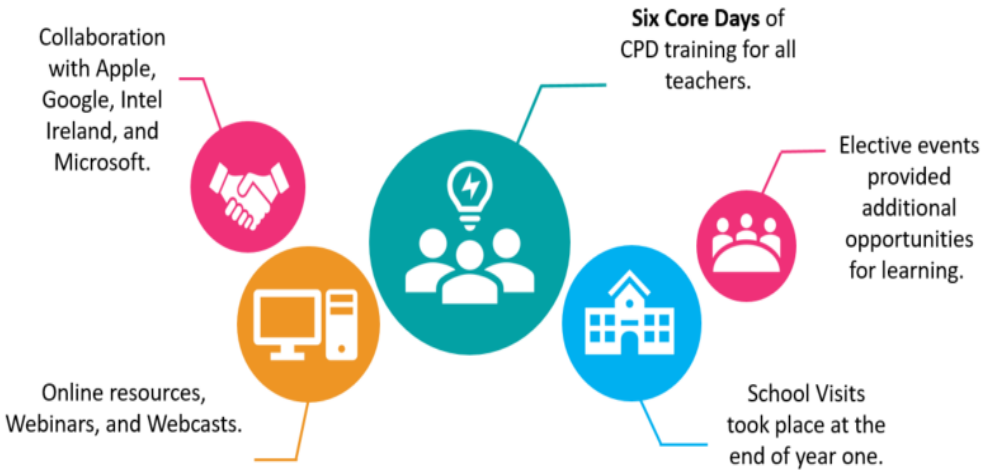

Figure 5 Overview of supports offered by the JCT

2. 3. 1 Coding Schools

Over one hundred and thirty schools have received support from the JCT since 2016. This diversity of schools and teachers, who have received support from the JCT, is well documented within the reports published in 2018, 2019 and 2020. These reports produced by the JCT and Lero found an almost split between male and female teachers in both the Exploring Coding and JCCiA initiatives and that Coding teachers came from a variety of subject disciplines (McInerney et al., 2018; Fleming & McInerney, 2019; Fleming & McInerney, 2020). While the JCT currently offers a specific CPD programme for schools offering the Coding short course, there is no requirement for schools to engage with these supports. It can be hypothesized that schools offer Coding outside of the official list released by the JCT (Donnelly, 2016, March 14). Figure 6 outlines the connection between schools' location involved in JCT supports and population distribution within the ROI on the right (Central Statistics Office of Ireland (CSO), 2020).

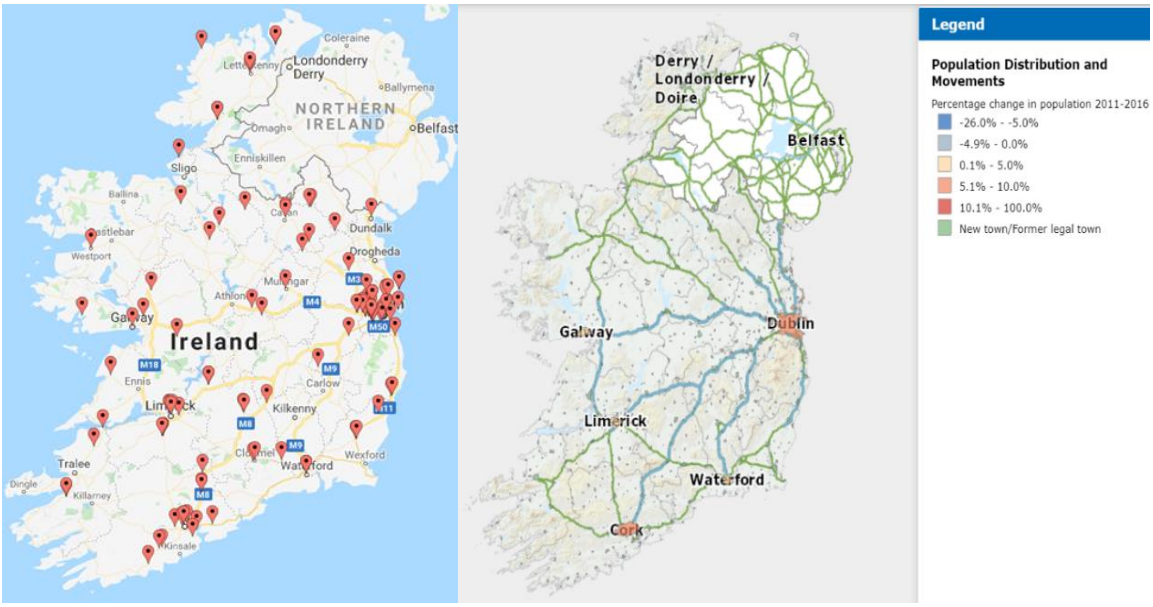

Figure 6 JCT Supported Schools v's CSO(2020) population distribution

2. 3. 2 Profiles of Schools

This section of the chapter will outline the profiles of schools who were part of the case study. These schools were both involved in the JCCiA initiative. Ethical approval for this project was granted based on the assurance that no school, teacher or student would be identified in the reporting of the results. Accordingly, the case schools are referred to as:

- **Urban Case School (UCS):** Is a co-educational community school; the administration is under the local Education and Training Board (ETB). The school has approximately 490 pupils and 30 teachers. The school was constructed within the past ten years and is located on purpose-built campus. It has a big open hallway, which contains administrative offices as well as a canteen. The building is well-light, and classrooms feel modern and user-friendly, with moveable tables and chairs. The computer rooms are located within meters of the school's main entrance/reception area. The computer rooms, of which there are two, are both equipped with stationary desks, with each midi-tower desktop computer attached to a monitor, mouse and keyboard.
- **Rural Case School (RCS):** Is a co-educational community school; administration is under the local Education and Training Board (ETB). The school has approximately 840 pupils and 40 teachers. The school

building was built in 1987 and has become unsuitable for the expansion in the student population, which has taken place, with upwards of twenty pre-fab classrooms being added to the school grounds. The building of a new school campus is currently underway with a planned opening in autumn of 2020.

Throughout this dissertation, Teachers will be identified using alphabetised markers, while student's responses, when quoted, will be referred to in numerical order.

2. 4 Conclusion

In summary, this section has shown that there has been a global expansion in CSE in schools, which has helped to inform and influence the current policy developments in the ROI. This chapter discussed the context in which these reforms were introduced. In the next chapter, we will examine the literature within the field of CSE and examine if there are any gaps in the existing literature.

Chapter 3 Literature Review

This chapter provides an insight into the emerging corpus of academic literature relevant to this case study. This literature review will expand on Crick's (2017) work and seeks to identify, appraise, and synthesize existing literature relevant to the project's aims and objectives.

3. 1 Design of the Literature Review

During the initial stages of the review process, it became apparent that due to the significant quantities of literature within the CSE domain, conducting a rigorous systematic review was problematic and would have inhibited the study's further development. Accordingly, multiple methods have been employed to refine the searches to reduce the literature review's breadth. One method employed, was the development of specific inclusion and exclusion criteria which were applied when researching and selecting works to review in advance of the commencement of the study; these are outlined in Table 1:

Table 1 Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
● English language ● Accessible to the researcher (no additional access payment) ● Focused on the area of CSE at lower-second level ● Case Study methodology employed ● Focus on teacher or student reactions or response to CSE 'impact' and 'enactment' of CSE policy	● Language other than English (unless already translated into English) ● Inaccessible through University login or open access research ● Focus on Primary or Third level CSE ● Focus on CSE within Mathematics or other subject areas. ● Focus on 'evaluation' of CSE initiatives

While every effort was made to facilitate a wide breadth of searchers, the research focused on quality over quantity sources. The research also sought to limit the possibilities of omitting relevant literature, which may

have provided additional depth to the study. Several critical academic databases have been targeted, including Google Scholar, ACM Digital Library, and LearnTechLib followed by searching international journals and CSE conference papers. This was followed by scanning documents and selecting for relevance. This process resulted in the creation of a selection of relevant papers. This list was used as an aid in creating an overview of the current landscape of CSE. Specific topics have been covered to add context to the broader discussion of CSE, but are not comprehensively covered; for example, subject status and pedagogical approaches in the area of CSE.

3. 2 Studies in the area of CSE

CSE often covers a broad range of knowledge that comprises programming languages, hardware and software designs, and retrieval of information and databases (Hubwieser et al. 2015). It is worth noting that the design and enactment of CSE curricula have a long history (Atchison, Conte, Hamblen, Hull, Keenan, Kehl, & Viavant, 1968). However, over the last twenty years, an increasing number of countries have positioned CSE as a core educational goal. Several audits and studies of these changes to an international level have been conducted by Hubwieser, 2013; Bell et al., 2014. The study of policy enactment within the area of CSE is also well explored with researchers like Baldwin & Apelgren (2015), Ball, Maguire, & Braun (2012), and Thompson, Bell, Andreae, & Robins (2013) exploring the role of teachers and students in implementing and enacting curriculum change. National examples include: Fluck et al. (2014) focused on the Tasmanian context, Khenner and Semakin, explored Informatics in Russia (2014) Wang, Hong, Ravitz, & Hejazi Moghadam, focused on the United States (2016), Furber at the United Kingdom (2012), and Raman et al., at India (2015). While these studies, were constructed with a desire to provide an insight into CSE at a national level, they have been critiqued by prominent authors like Bell, who highlighted the lack of clear boundary setting when defining Computer Science and use of generalizations when discussing ‘adoption’ within countries and across states lines (Bell et al., 2014).

Following Bells criticism, several attempts have been made at both national and local levels to address this lack of clarity and provide a focused view of adoption in context. Fluck et al. (2016) and Hubwieser et al. (2015) explore the relationship between policy enactment and CSE in second-level education. While others,

like Bernstein (2000) explored the complex interplay between pedagogy, symbolism and identity, topics that this thesis set out to explore. Another example of focused study is the geo-specific reporting, utilised by Fancsali, Tigani, Toro Isaza, & Cole (2018) in New York, Crick (2017) in Israel and Perry (2015) in Northern Ireland. In each of the above studies, researchers attempted to deepen understanding of the complexities of introducing Computer Science, which also address the impact of context and content on early adoption of such policies.

The researcher would like to draw attention to three studies, which acted as a core reference material for the researcher throughout the study's construction. They were:

- "Establishing a nationwide CS curriculum in New Zealand high schools" was authored by Tim Bell and published in February of 2014 in *Association for Computing Machinery (ACM).*
- "A Landscape Study of Computer Science Education in NYC: Early Findings and Implications for Policy and Practice", authored by Fancsali et al. (2018), in the proceedings of the 49th ACM *Technical Symposium on Computer Science Education*.

These and the aforementioned studies have highlighted some core issues within CSE; these issues will be explored in the next section.

3. 3 Subject Definition and Design

One area which has received consistent attention, throughout the above studies is defining the study and scope of Computer Science and thus, what CSE should encompass. Powerful rhetoric, inclusion and exclusion, and persuasive language were popular tools in computers disciplinary debates, with proponents of a mathematically based view of the subject achieving the rhetorical higher ground in the 1950s. In the 1960s with the development of the term software engineer, the subject was pulled towards a practical application of the subject, and a drive toward engineering and hardware dominated the decade (Fleming & Harford, 2014, p. 206-7). According to Margolis and Fisher (2002), the practice of 'grouping Computer Science with Mathematics and Science, both informally and organizationally, may exacerbate the gender gap in computing' (p. 37). Studies by Fennema (2000), Eccles (1989, 1994) and Hyde (1990) show that women are significantly less confident than men in science and mathematical ability, even when they have the same ability and grades

as their male classmates (Margolis & Fisher, 2002). Margolis and Fisher found that exposure to the subject at second-level was critical for women who elected to study third-level Computer Science (2002). Two-thirds of the women interviewed felt that they did not fit the stereotypical vision of what a computer scientist 'is' and this is critical as one in five of all women interview felt they did not belong (p. 259). For Tedre (2014), other subject's disciplines' viewpoints have dominated the discussion on Computer Science's identity (p. 2015).

This contention has had a profound impact on the construction and development of school-based CSE programmes. Governments are continually looking for best practice, and the availability of a readymade policy initiative can prove seductive (Fincher & Robins, 2019). At the same time, it is known that context and cultural factors vary from one nation to another, from one education system to another, and even from school to school within the same national system, in such a way to impact significantly on policy enactment (Steiner-Khamsi, 2013, p. 21). Much of the recent literature within the Irish research context has been focused on digital skills and integration of computing and technological devices to assist learning in other subject areas (Quille et al., 2018).

3. 3. 1 Subject Recognition and Status

Academic writers, including Berman (1978), Cedefop (2014), and more recently Tedre (2014) in his book *The Science of Computing Shaping a Discipline* discussed the issues which the interdisciplinary nature of computing. For Tedre, this primary issue was that CSE departments had been formed by multidisciplinary teams, which according to his research caused significant issues for students whom he contended '...were not equipped with the fundamental knowledge needed for long term understanding of Computer Science' (2014, p. 2). Tedre cautioned that Computer Science had become a discipline crowded with 'anthropomorphic buzzwords' and those they confuse 'toys with useful tools' within many third-level institutions' (2014, p.3). Second-level educators need to be cognisant of the errors produced at the third level. Accordingly, within governmental and research publication on recent reform, a collaboration between teachers is strongly recommended.

Within the Irish educational context, when it comes to recognising the subject, there are four main challenges.

- Firstly, teachers are awarded their recognition from the Teaching Council, the statutory body regulating standards in the teaching profession. While the current guidelines recognise ICT, Computer Science has only been recognised since 2019 and Coding is not recognised by the teaching council (Teachingcouncil.ie, 2020).
- Secondly, almost all other subjects have also gone through substantial reform since 2013 (Association of Secondary Teachers in Ireland, n.d.).
- Thirdly, as Coding is a new subject, teachers, even those with comprehensive subject knowledge, have to formulate pedagogical content knowledge for this new learning area.
- Finally, teachers often have different understandings of Coding, with teachers viewing the course from within their subject lens (Benitti, 2012).

Thus, it can be challenging for a clear understanding of the boundaries of the subject to be found, and confrontations may arise as these boundaries are constructed and dismantled.

Looking at Coding from this perspective highlights the importance of subject status for teachers' identity and the extent to which they will identify with a particular subject. Others such as Guzdial and DuBoulay (2019) have raised similar computing status concerns in other jurisdictions. The subject status also has a documented influence on any subject's position within a school. If the subject is perceived as having low status in the school (compared to their existing subjects), identification with the new subject will not occur (Baldwin & Apelgren, 2015). In a study carried out by Guzdial and DuBoulay (2019), found that some CSE teachers did not identify with Computer Science due to departmental hierarchies and its status. For that reason, they did not see CSE as part of their own professional identity and instead continued to define themselves according to their original subject specialisms (Guzdial & DuBoulay, 2019). Accordingly, the teachers involved in the study will be asked to discuss their identity; also, the researcher hopes to be cognizant of identity and subject status issues when speaking to and observing Coding teachers.

3. 3. 2 Pedagogical Approaches

This leads to a discussion of pedagogic approaches and the construction of learning resources. These are intrinsically linked to both teachers' perceptions of the subject and the teacher's existing pedagogical understanding (Fincher & Robins, 2019). As discovered through the examination of the literature found a variance of approaches form Benitti (2012) focus on robotics through to Brennan (2015), who focused on both the application and use of technology (Papert, S., 1987). Crick (2017) strongly stresses the utilisation of game-based learning as a form of pedagogic approach necessary to support the acquisition of skills and knowledge in CSE. Another pedagogical approach that has helped shape attitudes towards learning in CSE is the apprenticeship model, which holds that CSE educators should consider the physical processes involved in developing and carrying out complex skills when teaching novice programmers (Crick, 2017). Apprenticeships are designed to combat these tendencies and to encourage educators to observe, to enact, and to practice programming skills as an apprenticeship (Balanskat & Engelhardt, 2015). Although traditionally applied to physical and vocational subjects, the apprenticeship model can also be applied to acquiring skills such as those required for programming. In this context, the educator showcases the process of programming and demonstrates it through writing, debugging and running ‘live’ code. This takes place whilst being observed by students (Crick et al., 2015). There is a belief that programming, as opposed to, say analysis of algorithms is closely related to theoretical skill, is crafted through immersion and programming practice (Falkner & Vivian, 2015). Thus it is essential to consider where learning within the area of CSE is positioned.

3. 3. 3 Learning to Code

Learning is often a subconscious task, where the actor is connecting previously mastered topics or refining previously held skills. There are some pre-established groundings in the literature to educational themes and how they support and underpin teaching and learning within the CSE classroom (Crick, 2017). Most epistemological frameworks are rooted within the constructivist philosophical viewpoint, which interprets learning as actively constructing when students interact with the world around them, rather than having understanding passively obscured (Sabatier, 1986). There is a distinction between social constructivism and cognitive constructivism; the first primarily focuses on the development of an individual’s understanding,

while cognitive constructivism focuses on knowledge constructed following discussion with others (Balanskat & Engelhardt, 2015; Bourdieu, 1998).

For students facing any form of curriculum, change can be daunting (Baldwin & Apelgren, 2015). However, when this change requires alterations to practice, content and knowledge, including skill acquisition often seen within the introduction of CSE, it can be hugely challenging (Thompson et al. 2013). When it comes to CSE learners, it is often argued that confidence is gained through mastery of threshold concepts. This is when learners feel that they have crossed over from being outsiders to belonging to the field they are studying (Margolis & Fisher, 2002). However, there is some dispute on how they apply to CSE (Boustedt et al., 2007). Crick 2017 has proposed that there are critical steps, which transforms student perceptions of CSE and act as building blocks within the area of CSE, seen in Figure 7 below:

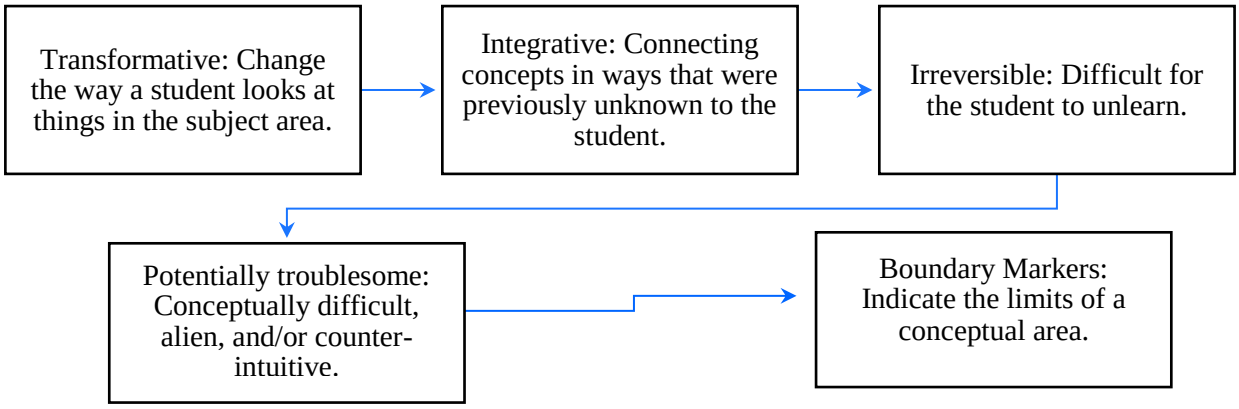

Figure 7 Threshold Concepts in CSE

According to Crick (2017), learners who have acquired these threshold concepts have, in part, transferred from being observers to actors, capable of understanding Computer Science (p. 8).

3. 3. 4 Assessing Student Progress

This naturally leads to a discussion of assessing student understanding of CSE topics. As expected, there is a vast corpus of literature on both innovative and practical assessment methods in CSE asking fundamental questions about what are we aiming to do when we teach programming (Fincher & Robins, 2019), through to attitudes and perceptions (Egan & Gurhy, 2020). There have been multi-national and multi-institutional studies of student attainment of programming skills of novice CSE students (Balanskat & Engelhardt, 2015), looking

at effective pedagogies (Sentence & Csizmadia, 2017). It is generally believed that early success in CSE is crucial for success on the examination and course. Students' particularities, densely connected CSE content, and recurring core topics suggest that it is difficult to rebound from early misunderstandings. However, there is still uncertainty around applying and articulating this understanding of Computer Science considering the dissonance between CSE policy and understanding of CSE. Crick (2017), contends that this difficulty in articulating and utilising domain-specific terminology can be a barrier to many who would like to teach and provide learning opportunities in the area of CSE to their students (p. 6). This sub-conscious uncertainty around core terminology can be one reason for various potential interpretations of policy or what Ladwig calls the policy enactment 'gap' (Ladwig, 1994).

3. 4 Policy Enactment

The treatment of a policy within the classroom is contingent and specific to the classroom's socio-cultural factors (Ball et al., 2012). The dissonance between the desire of the policy and the treatment of the policy within the classroom can be understood as the 'policy enactment gap' (Ladwig, 1994). Ladwig first proposed this term to define the space between the envisioned enactment (the specification) of the policy compared to the policy's treatment within the field, the action of policy enactment (Ladwig, 1994). Lindblom and Woodhouse, added to this understanding when he described policymaking as "the perpetual interaction of ideas and participants" (1980, p. 10). The complexities of policy enactment are an iterative process, which does not have a beginning or end (Lindblom & Woodhouse, 1980). Lindblom and Woodhouse describe the process of policy enactment as a ladder, with layers of power, responsibility, and action. At the top of this ladder are 'proximate policy-makers', responsible for immediate legal authority and who make decisions around specific policy, and who work together with other actors to make policy decisions' (Lindblom & Woodhouse, 1980, p. 14). At the base of the ladder are what Lipsky termed, street-level actors that are, those whose role it is to interpret policy on a day-to-day basis (2010). Rawolle and Lingard 2015, counter with the assertion that the school context and notably, the classroom setting is problematic when it comes to policy enactment (Ball et al., 2012). Therefore when looking at CS integration, one needs to examine existing classroom practices.

3. 4. 1 CSE Teachers

For Stenhouse (1980), teachers change classrooms, not policy, protocols or reforms (p. 44). This idea of identity, subject status and the issues faced by Coding teachers in both of our case study schools will be explored in Section 5.4.1. Despite this, it remains critical to the clear understanding of change within context to examine educators' perceptions and views. In 1996, Sabatier coined the phrase ‘local lens’ which observed both geopolitical context, the organisations (schools) ideological beliefs and perceptions of educators. According to Karseth and Sivesind (2010), a close look into local actors is essential, as educational reforms are only possible by adopting a ‘change mindset’ and the incorporation of tactical planning among local actors (Karseth and Sivesind, 2010). Ball et al. (2012), goes even further, to contend that teachers are one of the key ‘street-level actors’ who are responsible for the enactment of policy changes. Accordingly, the researcher has sought to capture teachers’ perceptions of the changes.

Like the subject, teachers who are currently teaching CSE, have no defined history but rather many intertwined histories that are “concerned with different motivations, needs, and aims, and that is rooted in different intellectual traditions” (p. 21). The understanding that teachers are critical to change in education, has a long history, in 1988, Goodson, published his pioneer study examining the role of educators. It has been highlighted by Yadav, Gretter, Hambrusch & Sands (2016) that the lack of trained Computer Science teachers has inhibited the adoption of CSE within schools in the United States. Observations from reports presented by Yadav et al. (2016) have revealed that there remain few pathways to pursue careers by Computer Science teachers due to the existence of less teacher education programs across countries Sentence & Csizmadia, 2017). The report conducted by CAS (2020) has identified that attrition within Computer Science teachers are affected when they are asked to teach subjects that require no computing. These issues related to computer science teachers' inefficient conditions indicate the development of policies and stringent curricular framework that will offer holistic support to teachers and thus upgrade their skills according to the demands of CSE.

Computer Science teachers typically work independently and often rely on virtual communities to stay in touch with colleagues, rather than through the frequent collaborations that in-house teachers may have

(Keane & McInerney, 2017, p.13). According to Lau (2018), there are some common issues which the teacher's face:

1. Where to start with programming? (Language selection)
2. The temptation to move quickly through concepts can lead to a gap within the classroom.
3. Only teaching the good, without explicitly telling students flaws of programming languages.
4. Encouraging copy and paste solutions to problems.
5. Forgetting about the bugs.
6. As in other languages, reading is more accessible than writing, so too with programming languages and educators should encourage students to read code (Lau, p. 122-6).
7. Thinking that technology is needed to write code, and that programming is an individual task.
8. The theory should be made concrete for students.

Thus we can see how there is a great deal of complexity when it comes to teachers understanding of the role and position of CSE. Accordingly, this study will examine in further detail the day-to-day experiences of Coding teachers.

3. 4. 2 Professional Development

According to Guskey (2002), '…professional development programs are systematic efforts to bring about change in teachers' classroom practices, their attitudes and beliefs, and the learning outcomes of students' (p. 381). These efforts may or may not result in actual educational transformation and change (Baldwin and Apelgren, 2015). Following personal construct psychology, it is suggested that when an individual discovers evidence that challenges his or her constructs, new constructs are formed, and the construct system is re-organised accordingly. This transformation is irreversible, bounded and sometimes regarded as uncomfortable since it involves a challenge to previously held worldviews (Pope and Denicolo, 2001).

In Ireland, the rising demand for investing in teachers' training in computing and its related topics have been supported by the JCT. Research has been carried out on larger samples of teachers involved in the Exploring Coding (McInerney, Carey & Power, 2018) and JCCiA initiatives (Fleming & McInerney, 2019; Fleming & McInerney, 2020). Within these reports, teachers' skills and confidence have been identified as one

of the significant factors in the study of CSE within lower-second levels. As highlighted by Fleming & McInerney, developing communities of practice and ensuring ample space for formal and informal teacher engagement opportunities is critical (2019). Given the strength and influence of subject subcultures in Irish post-primary schools, the community plays a considerable role in capacity building.

3. 4. 3 Effective leadership

Researchers in CSE have often highlighted effective leadership as a crucial aspect that promotes effective and smooth integration of CSE curricula in schools (Marcus-Quinn, Houriga and McCoy, 2019). Dempsey (2016) criticises that there is compelling evidence regarding the inefficiency of leadership. This inefficiency in leadership highly affects the policies and approaches carried out to attain positive CSE outcomes. The further researcher states that the quality of leadership practised within the curriculums of school activities as a determinant in school effectiveness and attaining good learning outcomes. Biesta (2009) state that leadership requires constructing a suitable road map, predicting the challenges and guiding decision-making. This blend of the contextual and policy planning should give policy change a firm grounding. Marcus-Quinn, Houriga and McCoy (2019) further point out that when facilitated by middle management, leadership can propel healthy and open dialogues that have a role in creating policies.

3. 5 Reporting

According to McLaughlin (2018), the enactment problem can often be ‘something of a surprise to planners and analysts’ (p. 180). It is also important to consider approaches to writing about both the classroom and school setting. Thomson and Hall (2016) caution researchers and policymakers, to avoid referring to ‘the school’ as if it were a generic institution and this type of authorship simplifies schools. It leaves them open to ‘the archetypical or stereotypical imaginings’ of the reader (p.8-9). One limitation of the current discussions around the integration and implement of CSE is the assumption that schools can be treated as generic institutions, with authors often focusing on the general picture. To avoid this, it was decided to catalogue the unique and singular impacts of educational reform on the two case schools by creating a snapshot of each

school, documenting their particularities, interviewing teachers and outlining each school's experience introducing Coding.

As outlined in Chapters Two, Coding has been introduced as a new subject within the lower-second-level school curriculum in many countries. As a new area of learning, Coding has been greeted by both excitement and apprehension (Lewis, 2017). Studies conducted by Dempsey (2016) have argued that it is necessary to hear the students' voices to understand change within an educational setting. Counter-arguments by Borrego et al., (2017) on listening to the student's voices, reveal that there often lies a limiting pursuit within the students in recognising change. The justification for the inclusion of the student's voice within this particular study will be outlined in Chapter 4. 5.

Teachers, who are often torn between the demands of teaching and the responsibility of enacting policy reform, are also a key focus throughout this study. Policy change places a great deal of pressure on teachers, who often view policy directives as secondary to routine. As outlined by Maynard-Moody and Musheno (2003), “street-level decisions and actions are guided less by rules, training or procedures and more by beliefs and norms, especially beliefs and norms about what is fair” (p. 6). Despite the current growing popularity of the CSE in ROI, little is known about the barriers facing female teachers and students within the field (Keane & McInerney, 2017, p.17). These issues around gender and diversity have not been specifically targeted for review within this case study. However, as outlined in Chapter Four, every effort was made to ensure representation for female students and teachers. The research will be reviewed within the discussion chapter through the prism of desirability, justness, effectiveness, and tolerability. These are the four areas outlined by D. Kerr (1976) as critical to adoption. According to Kerr, ‘a policy that cannot be implemented cannot be a successful policy’ (p. 359). Thus by understanding and reviewing each of the four areas listed above, this case study's researcher hopes to answer each of the four research questions seen in Section 1.3.

3. 5 Conclusion

While reviewing the literature, commonly experienced issues found within previous literature have been identified. With the help of evidence and data, the literature review provides some strong foundation to the

research study by unveiling areas which require careful consideration. This chapter has given an overview of some of the relevant literature within the field of CSE. It has caused the researcher to focus on the study's need and highlighted areas that require the researchers to focus during the study's construction.

Chapter 4 Methodology of the Study

This chapter presents the conceptual framework, design, data collection and analysis methods used throughout this study. It discusses the ethical issues related to the study as well as the trustworthiness of the analysis. The methodology was aligned with the four research questions which guided this research study. The four questions were:

1. What are teachers' perceptions and experiences of implementing the short course in Coding?
2. What are students' perceptions and experiences of learning in the short course in Coding?
3. How is the short course on Coding being implemented in the two schools?
4. What similarities and differences are observed between the two schools in their implementation, and what can be learned from this comparison?

4. 1 Philosophical Position and Choice of Methodology

The study has been designed to gain an insight into the successes and challenges of enacting the Junior Cycle short course in Coding. Different philosophical positions can influence the choice of research paradigm in educational research (Bryman, 2012). At one extreme, people might believe that there exists an external reality that can be discovered unambiguously using objective measures: this paradigm points the researcher towards using quantitative methods involving, for example, experimental designs and statistical sampling to make generalisations about a population. On the other hand, others believe that reality is experienced uniquely by each individual, and instead, interpretive methods must be used to uncover and analyse this reality. In interpretive research, it is the perspective of the participants that matters. An emphasis on the social world and how people interact, interpret, and construct meaning within it is a characteristic of qualitative research (Bryman, 2008), aligning with a social constructivist framework in this study. According to Atkinson et al. (2001), qualitative is an 'umbrella term' (p. 7), where several different approaches fall within this wider framework. Bassey (1999), explains that interviews, observation, documents and participant observation are possible sources of data which can be used within qualitative research and were employed in this study.

Since the research questions guiding this study were concerned with teachers and students perceptions of a specific educational innovation, the interpretive paradigm is most relevant in directing the choice of methodology. While many possible methodologies could be chosen, the decision was made to conduct case studies. Other approaches considered included action research (Cohen, Mannion, & Morrison, 2007), which involves teachers setting goals, planning, implementing, and reflecting in a series of cycles or iterations. However, this approach was deemed unsuitable because schools were already implementing the new Coding short course. So the preferred approach was to seek to understand how schools were implementing this change. The research was completed with teachers and students' collaboration in two Irish second-level schools, which involved the Exploring Coding and the JCCiA initiative. The schools involved provided a rich insight into the short course enactment in Coding lower-second-level.

4. 2 Case Study in Educational Research

Stake (1995) contends that the interpretive researcher must try 'to preserve the multiple realities, the different and even contradictory views of what is happening' (p. 12). It can be challenging to define a case study, but a standard definition is that it is the study of a bounded system. A bounded system can be an individual, a group of people, an organisation, a social system – but the system is defined by inclusion and exclusion criteria that mark out boundaries of the case. A vital characteristic of the case study is that it generates an in-depth, rich description of the case that resonates with the reader's experience (Yazan, 2015, p. 139).

Stake (1995) distinguished between three kinds of case studies. An intrinsic case study is concerned with just one case, without any interest in its representativeness of other phenomena. On the other hand, an instrumental case study is selected because it has features typical of a group of phenomena. The third type, a multiple case study, involves more than one case, and the aim is to make comparisons that illuminate common or contrasting features. A comparative case study design was chosen to address the study's research questions in the present study. A multiple-case study design is also more robust than a single-case study design, as the evidence is often considered more compelling (Yin, 2014).

The research design of this study is a qualitative comparative design (Ragin & Amoroso, 2011). Comparative research examines similarities and differences across cases and is well suited for understanding

diversity between and within cases (Ragin & Amoroso, 2011). Diversity is described by Ragin and Amoroso (2011) as vital to comparative research. They explain that 'the study of diversity is the study of patterns of similarities and differences within a given set of cases' (p.137). Furthermore, in the exploration of diversity in social research it is essential not to assume uniformity between cases, even though they might have been defined in the beginning as 'the same' or having the same 'system' (Ragin & Amoroso, 2011; Steiner-Khamsi, 2013).

A qualitative comparative design involving a multiple-case study requires examining two or more cases using identical methods (Yin, 2014). Multiple-case studies have proven to be frequently used in social science research, such as in Development Studies, Cultural Studies, and Education research (Yin, 2014). According to Yin (2014), case study as a method is useful for investigating contemporary phenomenon in a real-life context. For example, decision-making is often a significant focus in case studies, illuminating why these decisions were taken, how and with what result (Yin, 2014).

4. 3 Case Study Design

A research framework is described as 'a tool to scaffold research and, therefore, assist a researcher in making meaning of subsequent findings' (Smith, 2004, p.167). Furthermore, a framework includes a series of concepts, assumptions, expectations, beliefs and theories that inform and support the research (Miles & Huberman, 1994). The study uses an innovative meta-framework, which investigates three layers of understanding. The study was centrally concerned with the teaching and learning of Coding, and this was investigated from institutional, teacher, and student perspectives, as shown in Figure 8. These three layers of understanding are also reflected in the study's research questions.

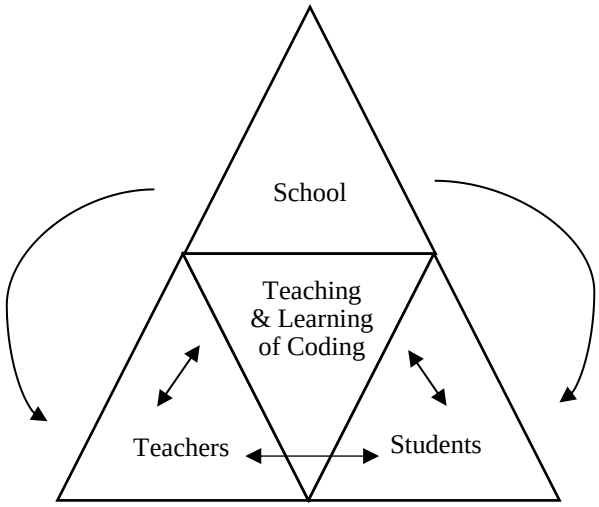

Figure 8 Study Framework

4. 4 Research Design and Chronology

This study aimed to understand teacher and students' lived experiences as it relates to the Coding short course. To meet this aim, it was necessary to collect data from several sources. Each of these data sources was selected following the examination of the research questions that had guided the study to date. Table 2 outlines how each of the data sources were used to address the research questions. The data sources listed in blue, were teacher interviews, student surveys, observations and school documents. A detailed description and justification for selecting each of these four data sources can be found below.

Table 2 Research Design

	Data sources			
Concept of interest	Teacher interviews	Student surveys	Observations	School documents
Teacher perceptions and experiences	**RQ1**			
Student perceptions and experiences		**RQ2**		
Implementation of the short course			**RQ3**	**RQ3**
Patterns: Commonalities and differences between schools.			**RQ4**	**RQ4**

The conceptual framework guided the research in terms of participants and methodology in this comparative case study. It used quantitative survey methodologies and qualitative components included in surveys, interviews, observations, and school documents (see Figure 9.

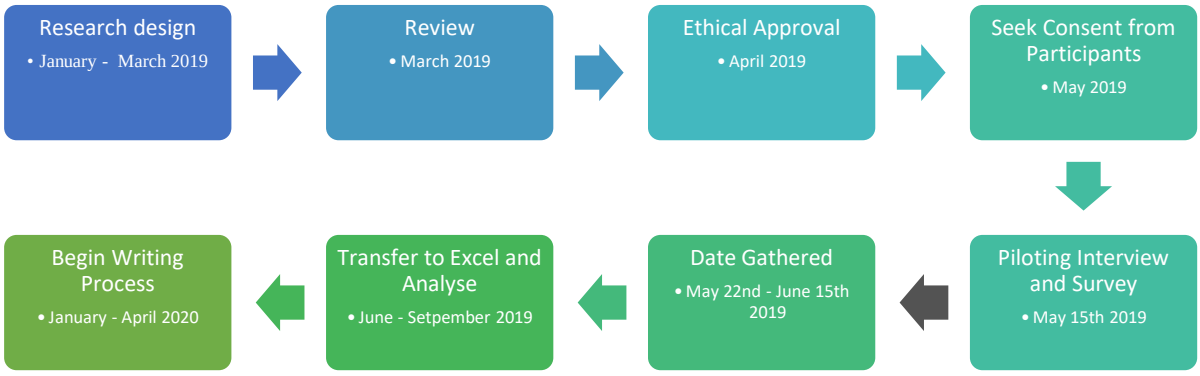

Figure 9 Research Chronology

The data was gathered from both schools between the 21st of May and the 30th of June 2019; this was the end of the school term when students, teachers and schools were preparing for the end of the academic examinations and school holidays. Accordingly, a vital consideration of the researcher was fatigue among both teachers and students. The interview and survey were piloted to combat this, and details relating to the time requirements were clearly expressed to participants in advance of the data collection period. Teachers were informed that the interview would last between 10-15 minutes. For students, the survey took 20 minutes to complete at a comfortable rate, with 10 minutes for each part of the study and the single class period provided ample time for students to read and understand the consent form and the research project. There was also time for collecting completed surveys at the end of the lesson, and students to ask questions about the research and the researcher. Due to the nuances of each specific case, each school is separated and examined individually. Table 3 outlines the specific details of the data collection process with UCS.

Table 3 UCS Table of Data

	Who or What	When (Date)	Where (Location)	How long (Duration)
Teacher interviews	Teacher A Teacher B	22nd May 2019 5th June 2019	School Site Telephone	15:05 – 15:30* 10:59 – 11:15*
Student surveys	3rd year (Group A) 3rd year (Group B)	22nd May 2019	School Site	45 minutes 45 minutes
Observations	School Site	22nd of May 2019	School Site	2.5 hours
School documents	1. School Inspection Reports (Subject) 2. School Prospectus 3. Online Sources (including social media accounts and school website)	22-26th June 2019	Available Online	16 hours

Note: *Duration of Teacher Interviews refers to the length of time researcher and teachers spoke, and the exact length of interview recording can be found in Table 10.

Table 4 outlines the specific details relating to the data collection process with RCS. As can be seen, the data collection process occurred between the 21st of May and the 30th of June 2019.

Table 4 RCS Table of Data

	Who or What	When (Date)	Where (Location)	How long (Duration)
Teacher interviews	Teacher A Teacher B	21st May 2019 18th June 2019	School Site Telephone	10:50 – 11:10* 08.47 – 08:59*
Student surveys	2nd year 4th year 5th year	21st of May 2019	School Site	45 minutes 35 minutes 40 minutes
Observations	School	21st of May 2019	School Site	3 hours
School documents	1. Whole School Inspection Reports 2. Inspection Reports (Subject) 3. School Prospectus 4. Online Sources (including social media accounts and school website)	26-30th June 2019	Available Online	20 hours (as an older school, there was considerable more documents available online).

Note: *Duration of Teacher Interviews refers to the length of time researcher and teachers spoke, and the exact length of interview recording can be found in Table 10.

4. 5 Participants

The research sites for this study were two different second-level schools in the Republic of Ireland. Each of these schools was chosen based on their proximity to the researcher; it was hoped that this decision would lead to flexibility on the researcher's part. As outlined above the participant involvement was required for two months.

4. 5. 1 Schools

To obtain a rich insight into the enactment of CSE in lower-second-level, it was necessary to explore the experiences of schools that had chosen to include Coding within their timetable. While no comprehensive list of schools of this nature could be found, information pertaining to schools that had elected to take part, the JCCiA initiative was available online. Thus a decision was made to reach out to these schools. The aim was to secure the participation of two to four schools in the study. In line with this aim, a letter was sent via post to four JCCiA schools inviting participation in the research study (Appendix I). Each of the four schools was contacted due to their proximity to the researcher; one was a single-sex school, one a Gaelscoil, one was urban and one rural. The invitation letter outlined the purpose and scope of the study.

Of the four schools that were contacted, two agreed to take part in the study. An overview of each of the schools that agreed to participate in the study can be found in Table 5.

Table 5 Case Schools

	UCS	**RCS**
Student enrolment:	504	708
School location:	Urban City	Rural Town
Type:	Mixed	Mixed
Ethos/ Religion:	Multi Denominational	Inter-Denominational
Status of Short Course:	Compulsory	Optional
Years of Coding:	3	4+
Is Leaving Certificate Computer Science offered in School:	No	Yes

4. 5. 2 Teachers

Once the schools had consented to be part of the study, an email inviting all Coding teachers to contact the researcher was issued. Two teachers in each school responded to the email. These teachers were then sent on the Teacher Information Sheet (Appendix IX), and they were all invited to participate in the study. Teachers' participation in this study was voluntary. They were given ample time to review and reflect on the study's requirements, up to two months between initial communication and the completion of the interviews. All participants signed an informed consent form (see Appendix X). Each of the teachers involved had a unique perspective and journey towards teaching Coding; an overview of the demographics of four teachers involved in the study can be found in Table 6 below.

Table 6 Teachers Demographics

	Age Range	Gender	Qualifications	Teaching in School since	Teaching Subject	Teaching Coding since	Support Received
Teacher A	30-35	Female	Bachelor of Technology (Education) in Materials and Architectural Technology	2010	Material Technology (Wood), Technical Graphics at lower-second-level & Construction Studies at senior-second-level	2013	JCCiA
Teacher B	30-35	Female	Bachelor of Science in Computer Systems and Masters in Mathematics' Education	2009	Mathematics at both upper and lower-second level, and Coding at lower-second level	2009	JCCiA
Teacher C	35-40	Male	Bachelor of Arts in Media Studies and History, Masters of Science in Interactive Multimedia & Postgraduate Certificate in Education	2007	History at both upper and lower-second level, Coding, ICT, Robotics and Media at lower-second level and Computer Science at upper-second level since 2018	2007	Exploring Coding
Teacher D	25-30	Male	Bachelor of Technology	2015	Materials Technology (Wood),	Expected 2020	JCCiA

		(Education) in Materials and Wood Technology		Technical Graphics at lower-second-level and Construction Studies at senior-second-level	

4. 5. 3 Students

Once the schools were selected, discussions were held with teachers to identify students' appropriate classes to participate in the study. Different circumstances existed in each school, which resulted in different classes and year levels of the student being invited to participate in the study. Letters were then sent to parents/guardians, and students received information sheets and consent form before the visit taking place (all attached in Appendix IV and Appendix VII).

In UCS, both teachers were comfortable with allowing their third-year students to take part in the study. These students were in the final term of their third-year junior cycle programming and fully understood the course's complexities. The teachers facilitated the distribution of consent to all third-year students who were studying Coding. They arranged a specific time for the researcher to visit the school, and it was arranged for both groups of third-year students to be free for a class period. Once the visit's date and time were arranged, consent forms were sent to parents outlining the visit's details. The school opted for the paper version of the survey, and the researcher printed these in advance of the school visit. Consent forms were given out to 38 students, of whom 30 returned consent forms with the signature of parents or guardians of students, see Table 7.

Table 7 Students of UCS

	Consent Requested	Consent Obtained
3rd year (Group A)	20	16
3rd year (Group B)	18	14

In the RCS, it was not possible to survey with third-year students as the teachers felt it would not be suitable, given the assessment pressures which the students were facing. Within this school, Teacher C was

the primary contact person; classes were chosen following consultation with him, and he facilitated the distribution of consent forms. Coding was optional within this school, and the teacher recommended attending the school on a Tuesday morning as this was when he had timetabled classes with all three groups of students.

There were limited numbers of 4th year/ Transition year students on-site during the data collection period. Ultimately, only four students returned the consent forms by the day the researcher visited the school. While these students took part in the study, it was not possible to collect data from other students within this class group. There was also a group of fifth-year students, who had a class period of Computer Science with Teacher C on the morning of the school visit; parental consent was gathered from 12 of these students out of a total of 14. The final group who were asked to take part in the study were a group of second-year students. A complete summary of the number of students in each group can be found in Table 8.

Table 8 Students of RCS

	Consent Requested	Consent obtained
2nd year	20	16
4th year/ Transition year	23	4
5th year	14	12

4. 6 Data collection instruments and procedures

There were four data sources: teacher interviews, student surveys, researcher observations, and school documents. A complete set of data collection instruments, including questionnaires and other written tasks, interview scripts and guidelines, and lesson observation forms, can be found in Appendices I to IV.

4. 6. 1 Teacher interviews

Interviews are widely used with education research, as they are a powerful way of obtaining information and gaining insights from participants (Brenner, 2006, p. 357). Interviews enable a certain degree of flexibility where the line of questioning allows the participants to move away slightly from the schedule. The researcher can use probing questions to enhance the richness of the data (Cohen, Mannion, & Morrison, 2007).

Each interview took place at a date and time decided by the teachers. The advantage of interviews is that they provided the researcher with opportunities to 'achieve a relatively high level of personal interaction while maintaining an acceptable level of standardisation' (Sharp 2012, p. 75). The use of this type of interviews allowed the researcher and teachers to talk more freely, and points could be elaborated on with the aid of prompts or further questions. Interviews facilitated honest and yet private descriptions (Denscombe, 2014). The approach outlined above was central to gaining an in-depth, rich understanding of teachers' perceptions and experiences of implementing the Coding short course. Therefore interviews, rather than written surveys, were selected for use with teachers within each case school.

The selection of suitable interview questions was a vital consideration of the researcher. The opening part of the interview consisted of teachers stating their name and the date as well as their consent to participate in the study. The remainder of the interview focused on the following five areas:

- Interviewee Background;
- Department and School setup;
- Perspective on CPD;
- Teaching and Learning; and
- Additional comments.

Qualitative interviewing tends to be less structured than in a quantitative strategy. In quantitative research, interviews need to be structured to ensure the reliability and validity of the concepts measured (Bryman, 2012). In qualitative interviewing, the aim is to explore the participants' perspectives. Semi-structured interviewing mirrors the flexibility of doing interviews in qualitative research: The 'researcher has a list of questions or fairly specific topics to be covered, often referred to as an interview guide, but the interviewee has a great deal of leeway on how to reply' (Bryman, 2012, p.471). All questions or topics in the interview guide are covered because the researcher wished to follow a pre-set script, but the researcher may ask the questions differently or ask follow-up questions (Bryman, 2012). This allows innovative ideas to emerge, as the participants may add information that was previously unknown to the researcher. A full list of the interview questions can be found in Table 9.

Table 9 Interview Questions

Part I	**Interviewee Background:**
	1. Where did you train?
	2. What are your primary subjects which you teach?
	3. When did you start teaching Coding?
	4. Why coding (question asked to understand motivation)?
Part II	**Department and School:**
	1. When did you start teaching in the School?
	2. Do you feel supported in this School? (Why?)
Part III	**Perspective on CPD:**
	1. Define CPD?
	2. How do you feel about CPD in general?
	3. What do you find challenging/successful?
	4. What is different about JCCiA CPD initiative?
	5. What are the barriers to CPD?
Part IV	**Teaching and Learning:**
	1. How do you feel you learn best?
	2. What are the benefits of the JCCiA CPD?
	3. What impact has JCCiA had on your teaching?
	4. What specific new teaching or assessment practices have you implemented in your classes?
	5. Has it impacted the way that you teach/ approach other subjects?
	6. What is being accomplished through the JCCiA initiatives?
	7. How do you know this?
	8. What, if any, changes to the programme would have made the experience more enjoyable/beneficial?
Part V	**Post Interview Comments or Leads:**

Care was taken to ensure that the interview's length would not be too taxing on the teachers. A pilot session was organised to ensure the researcher's familiarity with the interview session flow and make minor adjustments to the questions if necessary. This pilot took place on the 20th of May 2019, and the questions were piloted with a fellow educational researcher, who had previous experience in interviewing teachers. In

May of 2019, teachers were contacted via email (Appendix IX) about the possibility of conducting a one-to-one interview with the researcher. These interviews took place at a time and location selected by the interviewee. Interviews ranged from 08:49 to 15:09 minutes (Mean 11:47 minutes) Table 10 summarises interview locations and times.

Table 10 Participant's Interview Times

No.	Pseudonym	Interview Location	Interview Length
1.	Teacher A	Telephone	15:09
2.	Teacher B	UCS School	10:55
3.	Teacher C	RCS School	12:17
4.	Teacher D	Telephone	08.49

Every effort was made to ensure that the interviews took place in an open, friendly, and reflective manner. An informal and conversational tone was adopted to facilitate ease in the atmosphere and support the participant's experience in-depth. The teacher interviews sought to explore experience through open-ended questions. Denscombe (2014) notes that the advantage of open-ended questions can 'reflect the full, richness of the complexities of the views held by the respondents' (p.166). All interviews were audio-recorded on a dictation device, and notes were taken during the interview process. Audio files were then transferred to an encrypted file on a password-protected computer. Transcripts were manually transcribed by the researcher and saved as an encrypted file on a password-protected computer. Once this process was completed the audio files were deleted from the device. The interviews were recorded with the participants' permission and transcribed verbatim, ensuring spoken communication nuances, such as colloquialisms and accent, were preserved. The researcher maintained exclusive access to this password-protected computer. Printed extracts of transcripts were reviewed only by the researcher and shredded immediately following their analysis and review.

4. 6. 2 Student surveys

The student survey was designed to give us an insight into students' perspectives, opinions and attitudes towards Coding. While the researcher had initially considered using focus groups or individual interviews, ultimately, it was decided that students might provide more honest responses by using a survey (McLaughlin,

2008). Most of the ten questions required students to provide a brief explanation recording their thoughts or opinions. In May of 2019, contact was made with the schools regarding the arrangement of times to visit. Schools were offered a choice of paper survey or web-based student survey. Both schools opted for the paper version of the student survey, and school visits were organised. According to Denscombe (2014) and McCabe (2004), there is little or no evidence to suggest that there is any significant difference or distortion of information with either mode of distribution. The survey can be found in Appendix VIII.

The student survey was designed following the examination of published surveys. The researcher also examined data already obtained via publicly available JCT reports and identified gaps within this existing data source: these gaps became the focus of student surveys. Questions were designed not to be leading or persuasive, so the utmost care was taken in their construction (see Table 11. The students were asked to explain or expand upon their answers to achieve a greater depth of understanding.

Table 11 Survey Questions

Part I	**Question**	**Response Measure**
	Do you agree to answer all questions truthfully and to the best of your ability?	Yes / No
	What year are you in:	1st year / 2nd year /3rd year / Transition Year
	Are you?	Male / Female /
	If you did Coding before, where did you do it? (Primary school/ club/ home)	
	Is the short course in Coding optional (you decided to study it) or compulsory (everyone has to study it) in your School?	Optional/ Compulsory
	Do you feel the short course in Coding should be optional or compulsory for Junior Cycle students in Ireland?	Optional/ Compulsory
	Please explain why?	
Part II	Please list what you like about the short course in Coding	
	Please list what you dislike about the short course in Coding?	
	What advice would you give to a teacher teaching the short course in Coding?	

	What advice would you give to another student who is about to start the short course in Coding?	
Part III	Has taken the short course in Coding impacted the way that you approach other subjects? If so, how?	
	Would you be interested in learning more about any of the topics you explored as part of Coding's short course?	Yes / No
	Please explain your answer?	
	Do you have any additional comments or feedback?	

Once the survey questions were constructed, they were piloted with a fellow educational researcher to ensure that they would provide enough detail and space for students to comfortably answer all questions. Following this piloting, the researcher changed the font and size used to improve readability. The researcher also made additional space on the page where students could expand on their answers.

In UCS the date was arranged for 2 pm on the 22nd of May 2019. On arrival at the school, the students were all in place within the computer room, and the researcher was given time to explain the research project and the survey. For this purpose, a brief presentation was prepared. Students were urged to read the information letter in full before deciding to participate. The survey was then handed out and collected by the researcher. Tables 12 and 13 show the numbers of students and surveys collected in each school.

Table 12 Students of UCS

	Number of Students Present	Surveys Collect	Duration of Time
3rd year (Group A)	15	14	45 minutes
3rd year (Group B)	14	12	45 minutes

The site visit for RCS was scheduled for the morning of 21st of May 2019; this was a time which suited Teacher C, the most as he had all three class grounds between 08:40 – 10:40 am. Exact details of the numbers of students present, the number of surveys collected and the duration of time the research was with

the students are listed in Table 13. As can be seen, students had ample time to review the survey as well as ask questions of the researcher.

Table 13 Students of RCS

	Number of Students Present	Surveys collected	Duration of Time
2nd year	16	16	45 minutes
4th year/ Transition year	4	2	35 minutes
5th year	12	10	40 minutes

4. 6. 3 Observations

Marshall (2006) considers observation as a fundamental element of qualitative research. Participant observation can often fall under the umbrella term of 'ethnography' due to the researcher's immersion in the participants' social setting. Still, in this study, the term participant observation best captures the approach that was used. Gray and Wilcox (1995) proposed that observation be taken to understand the school setting by exploring critical areas. The three areas that were given particular attention during the observation period were clarifying values, teaching processes and critical resources (p. 38-9). An outline was created based on these three areas and a template constructed within the researcher's notebook on the day of each school visit; this can be seen in Table 14.

Table 14 School Evaluation Framework (Source: Gray & Wilcox (1995) p. 38-9)

Key Areas	Key Questions	How?	Where to look?
Clarification of Values	What are the schools fundamentally about?	Observations and analysis of School media.	School grounds and website
Teaching Processes	What does teaching and learning look like in this School?	Observations of the school environment	Observations of interactions
Key Resources	Pupil's access to resources	Class Size, materials available to students around the School	Classroom layout and resources, within the hallways (lockers,

			other spaces for learning)

This table was used during the school visit and was especially useful in the construction of the profiles of each of the case schools found in Chapter five. It also provided the researcher with an opportunity to check that the information provided by both students and teachers was reflected within each case school.

4. 6. 4 School Documents

According to Thomson and Hall (2017), there is a great deal which can be learnt from reading a school (p. 97). Reading a school involves exploring both 'written' and 'visual' sources to understand the school; these can include signs, school displays, school website or other sources (p. 101). Within this specific case study, the sources which were explored were divided into three categories: school inspection reports, school produced materials, and online sources, see Table 15. The sources which were examined were solely those publicly available during the research period.

Table 15 School Documents

	UCS	**RCS**
1.School Inspection Reports	English Inspection 2018	Whole School Inspection Reports conducted in 2016 with follow-through inspection in 2017 Spanish Inspection 2007 Italian Inspection 2009 Chemistry Inspection 2010 Irish Inspection 2010 Home Economics Inspection 2012 Music Inspection 2012 Guidance Inspection 2013 Biology Inspection 2014 Technical Graphics and Design & Communication graphic Inspection 2019
2. School Produced Materials	School Prospectus Published in 2020 Student Timetables	School Prospectus Published in 2018 Student Timetables Teaching materials

	Teaching materials	
3. Online Sources	School Website & Social Media Accounts (Twitter)	School Website & Social Media Accounts (Twitter & Facebook)

4. 7. Data Analysis Methods

Ozga (2000) cautions that the data collected must be captured and analysed without bias and that consistent data analysis strategies must be used. This research study gathered both qualitative and quantitative data; each of these has multiple methods of analysis. As Cousins (2009) explains, 'qualitative data analysis explores themes, patterns, stories, narrative structure and language within research texts (interviews, field notes etc.) to interpret meanings and generate detailed descriptions of research settings' (p. 31). With two separate research sites to consider, this study includes a substantial amount of data: accordingly, data analysis techniques were critical to the construction of a clear description of each case (Thomson & Hall, 2014). Patton (2002) highlights that analysis transforms data into findings; he adds that no one formula exists for that transformation. However, general guidance can provide the researcher with a pathway for understanding and managing the data acquired (Patton, 2002, p. 432). Categories and trends were identified and reflected on the data as trends and patterns emerged throughout the various data analysis phases (Stake, 1995).

Miles & Huberman (1994) guided the data analysis process, who describe three stages for data analysis; data reduction, data display and conclusion drawing and verification. An outline of the approach proposed by Miles & Huberman (1994) was applied to this research study can be seen in Figure 10. Two additional areas were added for this research study; these areas are data reduction due to the type of data gathered and data verification, which was added to ensure that the finding accurately reflected both students and teachers' experiences.

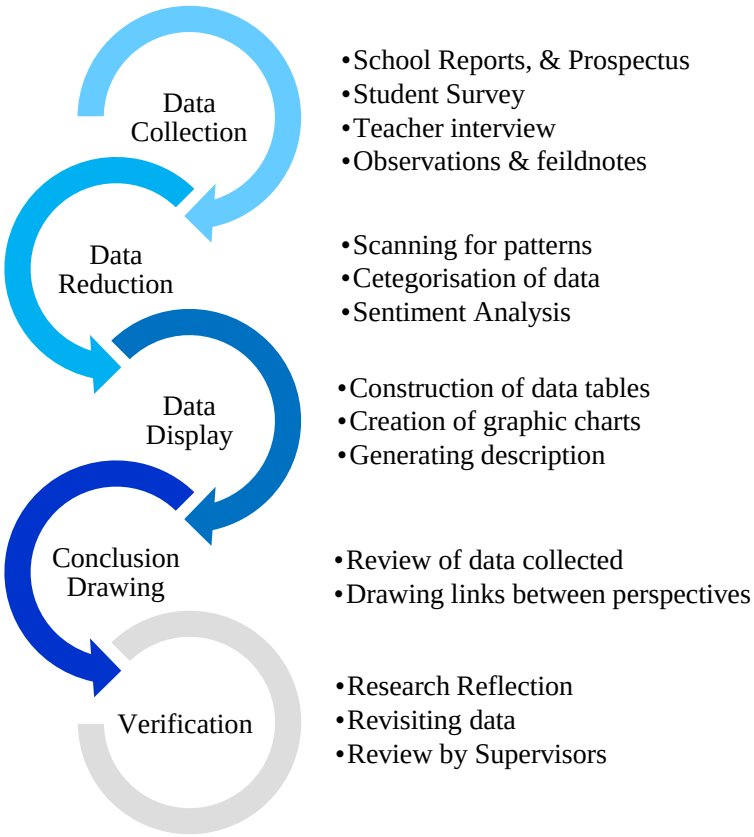

Figure 10 Data Analysis Process (amended by Research)

4. 7. 1 Teacher Interviews: Coding and Categorization

All four teachers took part in recorded semi-structured interviews, between 20th of May to the 18th of June 2019. These interviews were then transcribed. The data reduction can be broken down into three key stages. Firstly, demographic data was extracted, including information relating to years of teaching, qualifications held, and subjects taught. Secondly, the transcripts from all four interviews were examined in their entirety, line by line, and key phrases highlighted manually. Thirdly, the responses to specific questions were reviewed, and teacher responses to related questions were grouped and organised under specific themes and the following headings:

- Backgrounds and experiences
- Perspectives and opinions of Coding
- Future hopes for CSE

The data were then displayed within an Excel spreadsheet file, where data tables and charts could be generated. Links were drawn between teacher perspectives and the other data sources; these links were then verified by reviewing the data and re-reading the original transcripts to ensure that the teachers' thoughts and opinions were maintained. The researcher also wished to remain cognizant of the context within which the interviews took place (at the end of the school year), and factors such as familiarity with the researcher and connection to the JCT which may have impacted the teachers' responses. To address these factors, the researcher sought to remain neutral during the transcription and data analysis process. During the summer, these processes were carried out when contact with others was limited, and maximum attention could be given to this complex and sensitive task.

4. 7. 2 Student surveys: Representation and Interpretation

Surveys were collected within each of the case schools on the 21st and 22nd of May 2019. Students completed student surveys by hand, and the first step in the analysis was inputting this data to an Excel file. This involved carefully reading the students' answers and ensuring the spelling and grammar mirrored what was given by the students.

When it came to representing the survey responses, data reduction was minimal. Several of the questions called for a dichotomous choice (e.g. yes or no, compulsory or optional). Response frequencies were recorded, and charts were constructed from these responses. Secondly, the qualitative responses were read through in their entirety, question by question, with critical phrases being highlighted manually. Answers were scanned to find similarities and differences within student responses, as well as reviewed for their sentiment. Sentiment refers to the degree to which the responses can be classified as positive, neutral or negative (Cambria, Das, Bandyopadhyay, & Feraco (Eds.), 2017). The student's responses will be reviewed using a free, open-source, sentiment analysis tool (Gate.ac.uk, 2019). The data were then displayed within an Excel file, where data tables and charts could be generated. This approach also allowed for comparison of student perspectives, and it was from these observations, conclusions were drawn. The last step in the process was examining if student responses were reflected or observed within each of the case settings. The student survey was then reviewed, and a random sample of surveys was re-read to ensure that details were correct.

4. 7. 3 Observations: Coding and Categorisation

Gathering of data relating to observations was limited to the school setting. These observations took place on the 21st and 22nd of May 2019 and began on the school's approach, when notes were made of the school's setting and location. Observations also took place once the researcher was within the school and inside each of the classrooms, where Coding was taught. These notes were scanned for patterns, and keywords were highlighted. The notes were then categorised under headings within the following three areas:

- Clarification of Values
- Teaching Processes
- Key Resources

The findings of observations were displayed within a descriptive discussion of each of the case schools within chapter five, and therefore limited time was spent on constructing data tables. This data was primarily used during the review process, and comparisons were made between school settings.

4. 7. 4 School documents

School documents were selected and reviewed to extract relevant information relating this to implementation of Coding within the school. Inclusion and exclusion criteria were formulated to guide the selection of relevant documents. The documents reviewed fell within one of three key areas: school inspection reports, the school produced materials and online sources. The data reduction process was extensive. Firstly, the documents were scanned to find information relating to the following:

- School location and demographics
- School Ethos and structure
- ICT and school approach to technology (iPads or Chromebooks)
- Links to external sites

Searches of each of the following keywords then took place: ‘Coding’, ‘short courses’, ‘Computer Science’. The researcher wished to find out if ‘Coding’ was mentioned within formal documents, and if so, whether it was stated that ‘Coding’ was optional or compulsory for students. In addition, notes were then taken as the researcher found references for the other keywords, with contextual information and position being tracked.

These notes were then further summarised and categorised as above and used to form narrative descriptions of each case school found in Chapter five.

In the concluding phase of the data analysis process, all of the above elements were reviewed to draw conclusions about each case school. The interview transcripts, student survey, field notes and documentary data were all re-examined, and summary charts were created: these can be seen in Chapter five. One key question was: Were there any similarities or differences in the language used in school documents and by students and teachers (if so, why?). Further methods were used to create a clear discussion of the research findings seen in chapter five and six. As the study consisted of multiple phases, the researcher needed to become immersed in the data, digest it, take it apart, reassemble it and subsequently identify patterns and regularity through reflection and possibly revisiting it.

4. 7. 5 Constructing the Two Case Schools

Gerring & McDermott (2007) influenced the construction of the descriptions each of the case schools. The researcher aimed to move fluidly between the gathered data and the narrative descriptions that were being constructed as the research continued. Figure 11 illustrates the eight stages included in this analytic process:

Figure 11 Analysis Process (adapted from Gerring & McDermott (2007)

4. 8. Ethical considerations

Prior to this study's commencement, ethical approval was sought and granted by the Ethics Committee of the University of Limerick (Appendix III). The Ethical Guidelines for Educational Research (British Educational Research Association, 2011) were used to ensure that this study upheld the highest ethical standards. It also adhered to the Ethical Guidelines for Educational Research, fourth edition (2018). For the teacher interviews, a description of the project was contained in the consent form which teachers were given time to review and in advance of the interview, and they had to read and sign the form in advance of the commencement of the interview. The teacher was informed that they could withdraw from the interview should they like to do so (Appendix XI Teacher interview).

No school, student or teacher was identified within this dissertation or at any other time when findings were being reported. The pseudonyms, UCS and RCS, were used for each case school and interviewed teachers were referred to as Teacher A, Teacher B, Teacher C, and Teacher D. All student written responses were coded with specific numbers to ensure that student's names would not be revealed to anyone. Once the analysis of the data was completed, any quotes from students were reported anonymously. The information which was gathered from the study was handled in complete confidence. Copies of the information sheets, consent forms and other correspondences between the researcher and the schools can be found in the appendices. Full ethics approval was granted on the 14th May 2019 with University Of Limerick Research Ethics Committee application reference 2019_05_14_ EHS.

4. 9. Trustworthiness

Trustworthiness can be seen as a method of ensuring that the study's quality is maintained throughout the research study (Yin, 2014). This process is often broken into four distinct categories, credibility transferability, confirmability, and dependability.

- *Credibility* refers to the researcher's confidence that their data is valid and that the conclusions drawn are accurate. To ensure credibility, the researcher used the triangulation of data. The original recordings and hard copies of student copies and documents were also reviewed before the publication of the data.

- *Transferability* is how the researcher demonstrates that the research study's findings apply to other contexts. To ensure this, the research was completely transparent in the production of the methodology chapter and all data collection methods were explained in detail. The interview and survey questions can also be found in the Appendices. Although the research aims to capture participants' individual experiences in the short course in Coding, it is expected that the findings would be relevant within a similar context. The data collection methods utilised within the study could also be used in other schools.
- *Confirmability* is the degree of neutrality in the research study's findings. Throughout the research study, the researcher was honest about her relationship to both the schools and the JCT. Cohen et al. (2007) contended that confirmability is a vital element of research. This study has adopted the 'auditing-approach', which entails having complete records from all the research phases (Bryman, 2012). Through this thesis, the reader is given access to the different steps taken, such as formulation of research questions and research purpose, selecting the research site and participants, data collection and analysis. The following measures were taken to ensure that the researcher's bias was offset:
    - All participants were assured that their responses would be presented anonymously, and they were encouraged to answer all questions truthfully.
    - Feedback from the research supervisors was sought at every possible stage through this process.
    - The researcher piloted the interview and student survey to ensure that appropriate focus was maintained and that questions were not leading.
- Finally, *dependability* refers to the extent to which other researchers could repeat this study and that the findings would be consistent (Bryman, 2012). In order to ensure this, this dissertation provides a clear description of the data collection methods and gives details relating to the length of time over which data was gathered. To further ensure external validity, this study provided detailed descriptions in the findings section and included quotes from the participants where possible.

Throughout the analysis period, the researcher also made a conscious effort to ensure an accurate representation of participant experiences was reflected throughout this write-up. In addition, Yin (2014) suggests that qualitative research should demonstrate sensitivity to the participant, researcher, and data context.

This study has endeavoured to remain sensitive to the participants' context in seeking to understand teachers and students' experiences within each of the case schools.

4. 10 Conclusion

This chapter provided a detailed description of the design and methodology chosen for this research, including participants and sampling procedures; data collection and analytical procedures; management of ethical concerns; and researcher commitment to the highest possible qualitative research standard.

Chapter 5 Research Findings

Within this chapter, the core research findings are presented. The purpose of this chapter is to outline the key findings of the study while being respectful of the multiple and complex actors within its case-specific context. In line with the research of Thomson and Hall, the findings examine the personal narrative of the local actors, with statistical data as well as the observations of the researcher (2016).

It is hoped that this chapter will provide a clear outline of the case schools while also addressing the research aims. Section (5.2) and (5.3) are dedicated to an exploration of each case school context. Following an exploration of the setting, there will be a dedicated section (5.4) which will layout the data which was gathered under each of the research questions.

5. 1 Research findings the Case Schools

A case study of both second-level schools was conducted. Field notes were taken, two teachers in each school were interviewed, and students from various year groups were asked to complete an anonymous survey. Following this, the data was carefully analysed and screened for patterns. Following the transcription of interviews, outlining teachers' thoughts and opinions and recording observations, a review of data took place. Within the schools, data was gathered around class size, facilities and the demographics of the area as well as information on the general student population. Analysis of the data from the case schools was based on Yin, 2014, who caution that writing is the researcher's critical responsibility; however, it is not an exact science and can be a complicated process for researchers (p. 230). As the researcher has an educational background, additional steps were taken to reduce biases. The researcher's thoughts and opinions are not represented below; only direct observations and local actors' information. This section will focus on the following areas:

- School background
- School Ethos
- School Approach to innovation
- Profile of Teachers
- Lessons from each case school

5. 2 Researcher Overview of UCS

The researcher observed that UCS provides a good case study of the daily realities of teaching and learning. Teachers and staff work every day to encourage retention and attainment of students who face significant social dislocation issues, poverty and community tensions. Within the schools, student attendance and behaviour issues, as well as the importance of fostering strong community links, tend to dominate teachers, parents, and managerial concerns. UCS teachers and management demonstrate a commitment to engagement with government lead CPD and supporting high-quality professional practice, which enhances learning within their classroom and across the school.

The researcher noted that the school is located in an area, which has seen unemployment rates falling, and population growth over the last ten years. The Census results for 2016 show that almost 50% of people living in this area are under 35years of age. Since 2018, the city's economic plan has been revised, with a greater emphasis being placed on increasing supports and decreasing social issues within the city. 'We are very mindful of the ever-changing educational landscape in which we operate…. we are highly committed to embracing new initiatives and methodologies to enhance our school's teaching and learning environment' (Principal of UCS, 2019).

5. 2. 1 School Background

As a result of extensive research, the researcher obtained and verified the following information regarding UCS. It is a co-educational community college in the ROI, educating students from various ethnic, faith, economic and social backgrounds. The school was established after the amalgamation of two schools and opened in September 2016. It operates under the trusteeship of the regional Education and Training Board (ETB). There are currently almost 500 students enrolled in the school. According to data obtained from the school, first-year was oversubscribed for the 2018/19 school year. The school's curricular programmes include the Junior Cycle and the Junior Certificate School Programme (JCSP), an optional Transition Year (TY), the established Leaving Certificate, the Leaving Certificate Vocational Programme and the Leaving Certificate Applied Programme. Staff have confirmed that the school participates in the Department's action plan for educational inclusion, Delivering Equality of Opportunity in Schools (DEIS).

The researcher observed that the area of the city where the school is located had been associated with gang violence and economic disadvantage. However, according to the Inspection Report, 2018, the school itself has been commended for the positive and supportive relationship between students and staff. Teachers report that while the recent amalgamation and construction of a new school, attainment and attendance have been maintained and expanded over the past four years. It is of note that coinciding with this move to the new school was the Junior Cycle reforms, which meant that teachers, students and staff had to adjust to physical change to the new school building and the integration with new staff, but also reforms to subject areas and evaluation. The school has shown a strong commitment to reform by including four optional short courses and engaging with classroom-based assessment and other curricular and non-curricular efforts within the classroom. In conjunction with this has been a timetabling shift to 60-minute classes across the school. Sample Student timetables can be seen in Appendix XIII.

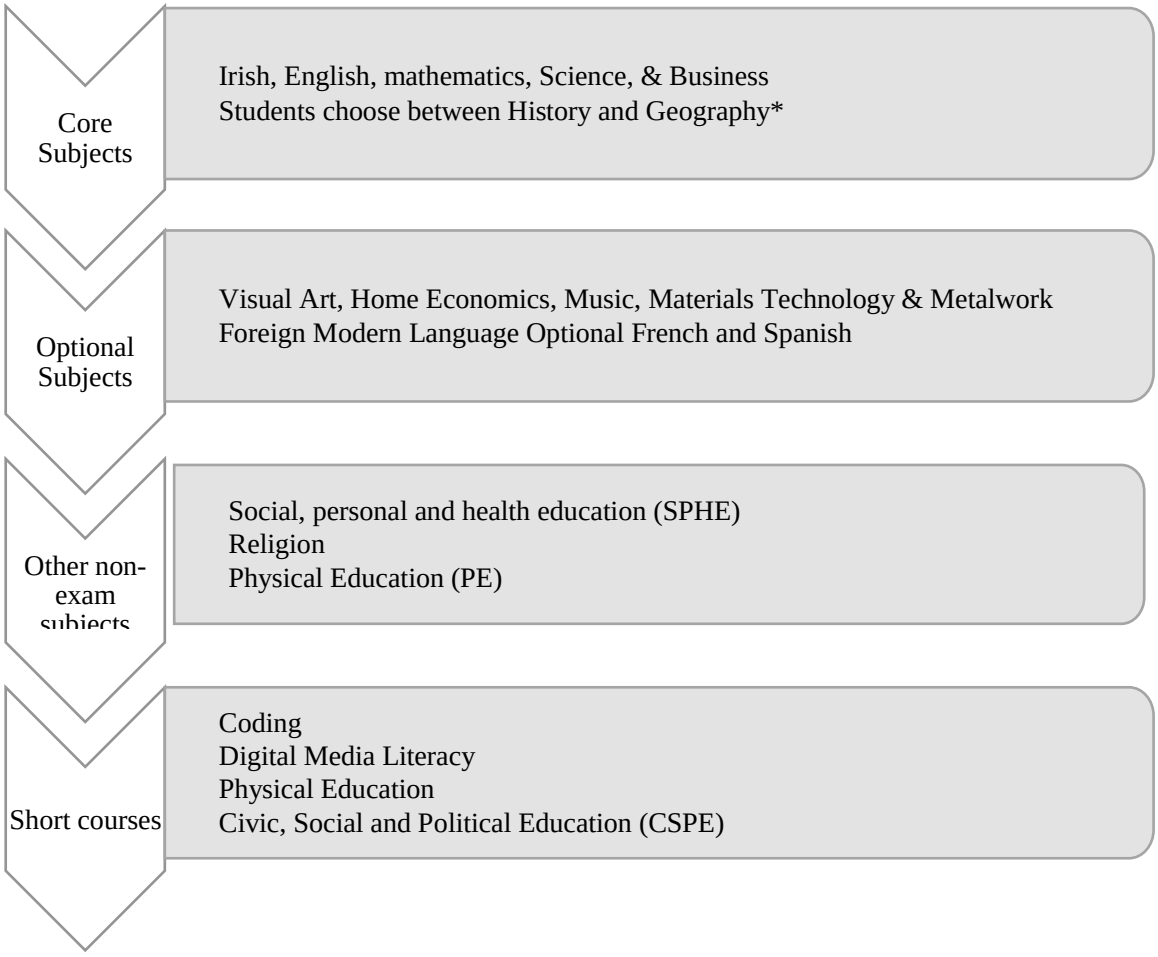

Figure 12 Subject Options

5. 2. 2 School Ethos

According to the interviews conducted with teachers, the new school management has emphasised team building. The school motto centred on the appreciation, celebrations, and education of young people. Upon visiting the school building, the researcher observed that teachers and staff were eager to recognise students' achievements and accomplishments. As outlined in the admissions policy, the school aims to create 'an inclusive atmosphere of friendliness, joy and celebration'. Teachers report that this is achieved through facilitating and supporting an active and creative environment through events such as a multicultural week, Seachtain Na Gaeilge, yoga and mindfulness workshops. One element, which the researcher noted was that the library, referred to as 'the heart of the school', was filled with vibrant colours, books, posters, and various learning spaces.

Figure 13 UCS Library

Another recent event for UCS has been the 'complete roll-out' of their new school uniform. According to the annual report, the school community's commitment to this 'new look' has been highly positive. Along with the school's reputation for 'not walking away' from discipline, teachers see the new uniform as enhancing the school reputation and adding to a collective identity within the eyes of students, parents and the wider community. The school also views its relationship with parents and the community as particularly important. The principal explained that the college's educational approach was 'to enable students to be respectful of diverse cultures and beliefs. Our school provides a rounded educational experience so that they will emerge from their time with us as responsible members of society'. As a school positioned in the city, students have a wide variety of resources and amenities

5. 2. 3 School Approach to Innovation

According to the principal, this new school has proved that joining a shared community of education from two separate institutions to a single unit is possible. The researcher observed that they benefit from sharing connections, resources, perspectives and approaches to educational reform. By looking at each of their prior schools' experiences and responses to education reform, we can see that both schools were engaging with educational reforms. Within inspection reports, produced by the Department of Education, it was observed that teachers were engaging in best practice in terms of curricular and pedagogical approaches. Inspectors noted the schools' commitment to student engagement and attainment. Teachers reported in their interviews that both schools had well-established community links, with parents, youth groups, and the industry as well as third-level facilities. One programme they have been engaged with for many years is the DEIS supported schools' Business Partnership Programme. This programme focuses on the development of employment and skills for the workplace. Key elements of the inspection reports, including:

- Use of Team Teaching
- Management commitment to the learning of both students and staff
- Resourced in terms of the allocation of teaching personnel
- Secure communication of students' needs among teachers
- Pro-active approach to developing cross-curricular links
- Willingness of the entire staff to engage positively reforms

As the students and staff came together, the principal reported that there was a shared singular desire to ensure a coordinated approach to teaching and learning. This unified approach was also noted in an inspection report carried out following the amalgamation. The school was commended on the 'establishment of a supportive working relationship' between staff who have come together to share resources, compile term plans across different year groups, and encourage participation in competition, clubs, and events that facilitate student learning.

According to staff, one element that proved challenging for this school was union directives, which recommended or petitioned against teacher involvement in educational reform. Despite this, the school

made efforts to facilitate and encourage individual engagement in professional development opportunities. In September of 2017, the new school successfully joined the Junior Cycle Coding in Action (JCCiA), which ensured that two of their teachers would receive two years of professional development support as outlined in Section 2.2. Within the following section, there is an outline of the details relating to both of these teachers. The information used to construct these profiles was gathered during the interviews, which took in 2019.

5. 2. 4 Teachers of UCS

Two teachers in the school agreed to participate in this study; each teacher acted as a Coding teacher within the school and received support from the JCT when the research data was gathered. Throughout our discussion of the case schools, the teachers will be referred to as Teacher A and Teacher B. Please see below an outline of the experience and professional training of each teacher.

Teacher A completed a Bachelor of Technology (Education) in Materials and Architectural Technology, and is qualified to teach Materials Technology (Wood), Technical Graphics at lower-second-level and Construction Studies at senior-second-level. This teacher stated that she had a strong desire to become a role model for students from the very beginning and encourage all students to develop a passion for learning and skill acquisition. She was also eager to challenge stereotypes in a subject area, which was traditionally seen as a male-dominated subject. Having attended a single-sex second-level school, which encouraged girls to develop technical and soft skills, this teacher was not fully aware of the lack of female role models in the area until she went to third level. Since commencing her career, she has been teaching ICT and computing at both lower and upper-second-level.

Teacher B has a Bachelor of Science in Computer Systems, following completion of this course. She worked in industry before deciding to study Mathematics' Education at the University of Hertfordshire, in the UK. Since commencing her teaching career, this teacher has been formally teaching Computer Science/ ICT and Coding. Over the years, this teacher has developed a keen sense of identity and developed her pedagogical, content knowledge within both of her subject areas.

Teacher A and Teacher B have been working together as the 'designated technology teacher', sharing responsibility for managing introductory and intermediate level computing courses for over ten years. The introduction of short-course at lower-second-level has been proposed for several years. However, these teachers had already been acting within their schools to give students Computer Science skills. In September of 2015, the Coding short course was brought into the classroom as a yearlong initiative called *Exploring Coding.* The programme was designed to provide support to schools with the implementation of the Coding short course specification. Exploring Coding was run by the Junior Cycle for Teachers (JCT) Short Courses Team with support from Lero – The Science Foundation Ireland Research Centre for Software – and Intel Ireland. In 2017, the schools selected both Teachers to receive support from the JCT as part of JCCiA.

During the interview, both teachers discussed the benefits of receiving this support. Although they had existing technical and pedagogical skills, they benefited in terms of confidence, competence and content. Teacher A stated 'CPD sessions were of immense help and support'. She also reported that they 'challenged' her to think outside the box and be more 'creative'. Engagement with JCCiA helped improve the teacher's practical knowledge, and she felt that she developed as a professional practitioner throughout the two years. She added that communication and collaborating with teachers in other schools 'encouraging teamwork, paired learning and much more'. This statement was echoed throughout the interview with Teacher B. Although she was already a qualified Computer Science Engineer and teacher, she said that she 'really enjoyed' and gained a great deal from the programme. She stated that 'after each session, I was more confident, and I had a few more ideas which I could bring back to my classroom'. This teacher felt that the skills she developed were highly transferable and improved her pedagogical approach. Having a clear pathway of learning and development-reduced stress levels helped create an effective action plan within the school. From the interviews, it is apparent that the CPD days motivated the teachers, helped them focus on critical areas for student learning, and sparked discussions on the classroom's priorities.

5. 3. 5 Students of UCS

Demographics were gathered on students attending UCS; over five hundred students registered within the school, with an almost equal split between students attending urban and rural areas. The student population's

diversity is also reflected in its ethnicity, with students from a variety of backgrounds and cultures. Students who took part in the survey were all in their Third year of Study and had completed two and a half years of study at lower-second level. Female students made up 75% of respondents, while the remaining 25% were male.

Information was also available gathered on the prior experiences of students. What was uncovered was that within UCS, less than 5% of Students had gained experiences of coding topics at home, while almost 60% had experiences at primary school. The remained of students had not engaged with coding before they began their studies within this post-primary school. The results of this question can be seen in the chart, as seen in Figure 14. All students who took part in the survey had a minimum of twelve months of experiences with the short course in Coding. Of the students who completed the survey most prior experiences with Coding at primary level (58%), with the second-largest cohort of students having no prior experiences of Coding (37%), only a small percentage of students had experiences with Coding at home.

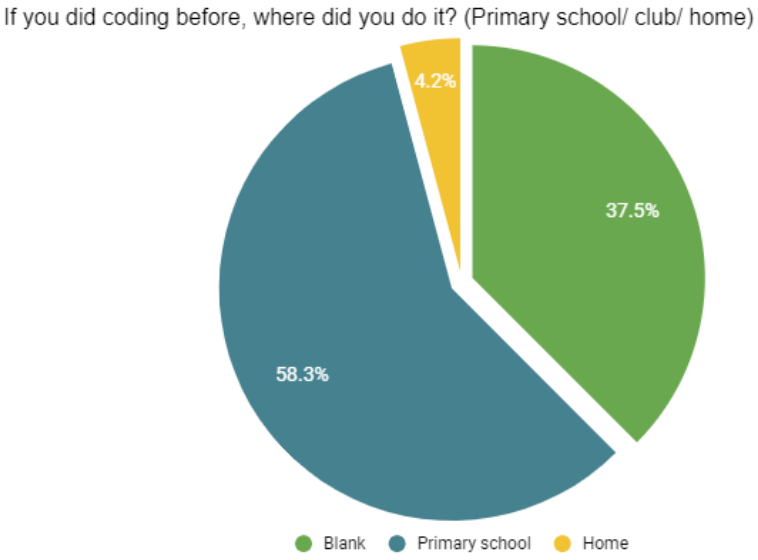

Figure 14 Student Prior Experiences

This variety in prior exposure to Coding was reflected in the student's qualitative responses. As can be seen in figure 15, a word cloud created from the qualitative responses of students. Most of the students expressed their 'interest' for the subject. When sentiment analysis was applied to students' qualitative responses, they were found to be positive (+0.67) with a Magnitude of 11.73.

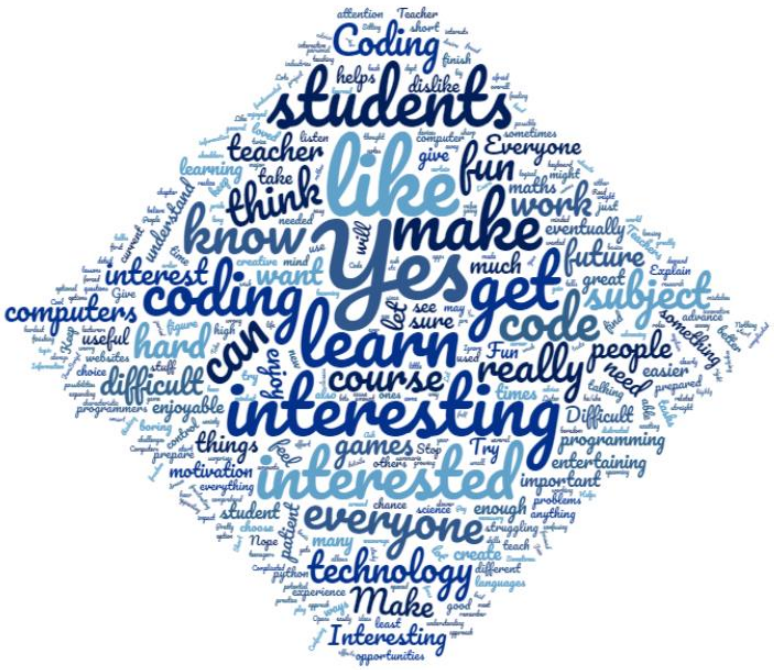

Figure 15 Student Wordcloud_UCS

As can be seen, the students' qualitative responses to the questions asked, students were very positive when it came to the short course. When keyword analysis was applied to the student, responses were explored, the following words appear in Table 16 below.

Table 16 Key Word Analysis

Girls of UCS	Boys of UCS
Coding	Long Run
Games	Lot of Information
Students	Short Course
Everyone	Code
Typing Skills	Scratch
Exam Subject	Practical Work
Pay Attention	Students Choice
Short Course	Coding
Educational Way	People

When these responses were divided by gender, due to the sharp contrast in the language used by female and male students, female students viewed the short course within the context of current learning and educational

development. At the same time, their male classmates took a holistic view of the practical skills they had developed and had a more long-term Coding approach.

Students' work was displayed throughout the school and were visible within classrooms and hallways around the school, as shown in Figure 16. Additional observations of the school building can be found in the Appendix IV.

Figure 16 Coding Classroom UCS

5. 2. 6 Lessons from UCS

This school can provide us with lessons, which other urban schools can utilise as they introduce students to Coding:

- Creating a robust internal communication chain between teachers and management is critical;
- Connections with external agencies can help to boost morale and interest;
- Holding school events and engaging in external competitions can add to student motivation;
- Tendencies towards treating students and parents in low socioeconomic contexts as deficit must be avoided;

- Efforts such be made to reduce reliance on expensive software, and open source or free software packages should be used;
- Reforms require school administrative staff and school management and teachers in such schools may require additional external support to avoid burnout. External support was given to teachers in this school;
- Providing opportunities for teachers to engage in external training and communication with teachers in other schools can aid in maintaining a focus on pedagogy rather over content;
- Valuing of teachers is necessary for improving teacher morale and continuity of initiatives;
- Recognition has to be given to the commitment of a large majority of teachers in such schools to the well-being of their students;
- Engagement with school life for some students is affected detrimentally by factors outside school; schools need to be made meaningful for disengaged students;
- Positive relationships between teachers and students are essential for engaging students in a new area of learning;
- Students with anxiety or additional learning needs are dependent upon explicit criteria being made available to them, such as assessment criteria;

Availability of resources outside of the schools setting is a particular issue facing students and teachers in this school.

5. 3 Overview of RCS

From the researcher's observations, RCS is an interesting case school as it is one of the fastest-growing schools in the state; it has also been referred to as one of the best schools in the country by local newspaper articles. The principal explained that the school experienced rapid expansion and quickly outgrew its school building. Planning permission was sought in 2016, for a new school campus, which is set to be completed in early 2021. The researcher noted that the school is located in a rural area, on the outskirts of a small Irish town with a population of fewer than 1,200 people (CSO, 2020); the school has over 800 students and 70 staff.

Accordingly, it can be deduced that the majority of students are not from the town itself but its wider hinterland and surrounding communities.

It is worth noting that this area's unemployment rate currently stands at over 30% compared with a national average rate of 5%. Teachers in the school report that it is highly regarded within the local area and seen to act as a positive light within the community, providing workshops for parents and caregivers and organised visits to national schools and nursing homes. ‘As a school, we pride ourselves on being a vibrant and ambitious learning community, where everyone is valued and has a part to play… our school was at the forefront in the development of several short courses’ Principal of RCS.

5. 3. 1 School Background

According to information received from the staff, RCS is a co-educational non-denominational second-level school in the ROI, educating students from diverse socio-cultural and ethnic backgrounds. The school operates under the auspices of the regional Education and Training Board (ETB). The school's curricular programmes include the Junior Cycle and the Junior Certificate School Programme (JCSP), an optional Transition Year (TY), the established Leaving Certificate, the Leaving Certificate Vocational Programme and the Leaving Certificate Applied Programme. The researcher has been informed that the current school building was constructed in the 1980s and has become inappropriate for the student population's level of growth, which has taken place. The building of a new school campus is well underway with an expected opening in 2020. When completed, the new campus promises to be one of the county's largest and most equipped facilities.

According to management, the school has been one of the fastest-growing second-level schools in Ireland over the past decade. The school has developed a compelling reputation for delivering high quality, innovative, and progressive education to students, particularly with its emphasis on the sciences, languages, technology and CSE. In 2012, this case school was one of the twenty-two schools involved in the pilot for the short course in Coding. Over the years, this school has been a leader in CSE developments; this innovative approach continues and now stretches to include the broad area of CSE as reported by the school principal. The school continues to build positive connections with industry and the third level education sector to support

student learning and opportunities in all areas, with extensive links to both local and national business and community initiatives.

The school provides a vivid account of the daily realities of teaching and learning in a school with large numbers of students from a diverse background, with a wide range of needs, skills, and interests. Teachers report that there is an opportunity to provide students with a wide range of subject choice within the school, as seen in Figure 17, and the ability to experiment with innovative methodologies and curricular changes. RCS demonstrates a clear path forward which other large schools can utilise to implement a range of short courses into their timetables, while also supporting teachers to develop high-quality methodologies to enhance the teaching and learning within their classroom and across the school.

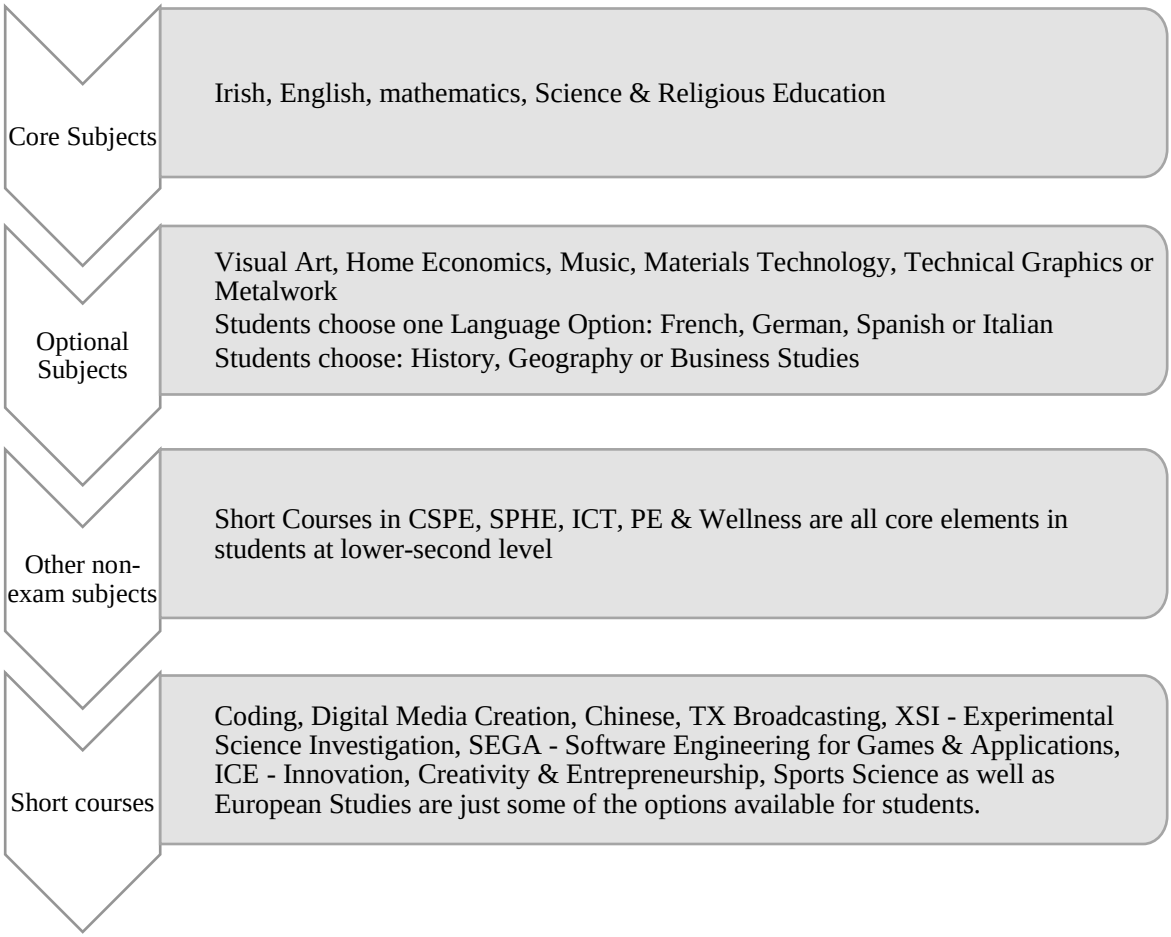

Figure 17 RCS Subject Options

It is worth noting that the school has shown a strong commitment to reform by including fourteen optional short courses and engaging with classroom-based assessment and other curricular and non-curricular efforts within the classroom.

5. 3. 2 School Ethos

According to school management, the ethos was founded on three key pillars, the schools' vision for future learning and development, the mission that focuses on inclusion, justice and service, and its goals, which were the pursuit of excellence, development of talents, and fostering of student wellbeing. Within the school admission policy, a core element of the schools' ethos was the support and development of a professional learning community, within the school, to support and foster staff's talents. It was evident that this had a positive impact on students' approach, which created a positive culture within the school. This, according to the principal, this encourages students to reach their ‘full potential and become mature and responsible citizens’.

The school have a continually active student council and a range of optional and inclusive extracurricular activities, in particular, they have an extensive range of sporting and cultural events throughout the school year, with daily after school and club meetings, weekly sports training, and clubs like yearbook committee and sports day. While the focus within the classroom was academic, it was evident from walking around the school's hallways that the school is committed to developing and fostering students' interests and non-curricular abilities. The hall was lined with photographs of past school musical performances and sporting events and awards from competitions.

The school has a very distinctive school uniform consisting of black shoes, white shirt, trousers or floor-length skirt, school jumper and a blazer. All students appear to have a commitment to the uniform with students adhering to the dress code in both the hallways and the classrooms. The school has a current DEIS status, and there is a book rental scheme, breakfast club, and meal plans in place as well as other resources designed to support the students' educational advancement. The school is located in an area with a high rate of youth unemployment economic disadvantage and is part of the School Completion Programme (SCP). SCP is a critical component of the Department of Education and Skills, strategy to discriminate positively in favour of

children and young people at risk or who are experiencing disadvantage. The programme aims to impact student retention levels positively.

As part of the School Completion Programme, this case school has a dedicated staff member, who works within the school, communicating with and fostering positive relationships with students and families, monitoring attendance and supporting students. In 2016, whole-school evaluation report, the school was commended for its strong leadership and commitment to supporting students (Inspection Report, 2016).

5. 3. 3 School Approach to Innovation

The school management has placed a strong emphasis on team building, as well as creating and sustaining innovative teaching and learning opportunities. The school is also committed to developing alternative educational models. Since early 2000, the school has continually updated and developed its resources and infrastructure, but the most notable change has been in terms of the number of staff and the vast array of technical, pedagogical and curricular knowledge, which they possess. Ten subject inspection reports conducted 2007-2019, and one Whole-School Inspection and follow-up inspection report were analysed as part of the research. Inspection reports are impartial observations of school leadership, teaching and internal processes within the school. The inspector communicated with students, teachers, and school management. The inspector reviewed the school planning documentation, observed lessons in progress and examined students' work. Key elements of the inspection reports highlighted the following elements within the school:

- High-quality student learning was facilitated through excellent quality, and in some cases, exemplary teaching.
- Strong emphasis on ICT and integration technology across a range of subject areas.
- School management support and facilitate teachers' engagement in CPD.
- Students are given excellent opportunities to make well-informed optional subject choices.
- Collaboration between internal actors around events and engagement with external connections is commendable.
- **S**taff are professional, dedicated and committed to their students and their work.

Students work was displayed throughout the school and were visible within classrooms and hallways around the school. Most rooms within the school contained movable chairs and tables and were decorated with posters, as shown in Figure 18. Additional observations of the school building can be found in the Appendix IV.

Figure 18 General Classroom RCS

5. 3. 4 Teachers of RCS

Two teachers from RCS agreed to participate in this study, one of the teachers was acting as a Coding teacher within the school, while the other had received training and is hoping to teach Coding from September of 2020. Both teachers received support from the JCT at the time when the research data was gathered. Throughout the discussion of the case schools, the teachers will be referred to as Teacher C and Teacher D. Please see below an outline of each teacher's experience and professional training.

Teacher C completed a Bachelor of Arts in Media Studies and History, followed by a Master's of Science in Interactive Multimedia before moving to the UK to complete a Postgraduate Certificate in Education. This teacher has shown dedication to the introduction of Coding and Computing for over ten years. Since he started in RSC in 2007, Teacher C has acted as an ICT coordinator and ICT tutor. In the rapidly expanding school, he has to divide his time between assisting his fellow teachers and helping his students. Both roles he excelled at and his actions have been noted within inspectorate reports. Teacher C has a dedicated classroom, which also acts as the ICT hub within the school filled with cables, and bursting with materials and

technology resources; the room holds several a set of iPads (Appendix IV), which can be booked and used by any class. This teacher's classroom door is usually open, and students and teachers arrived throughout the day with questions, queries, borrowing and returning resources. It was evident that the teacher was well respected within the school and viewed as the 'expert within the school'. The challenge for a teacher who is given this title is that they can often be overburdened with additional administrative responsibilities, which can lead to teacher burnout.

Teacher C was part of the initial piloting of the short course in Coding; he was also part of the team that was consulted on the Coding specification itself. In 2016, he received support for practice through the Exploring Coding initiative. Following the completion of this programme, he was involved in the provision of CPD, acting as a part-time Associate with the JCT, as part of the Junior Cycle Coding in Action (JCCiA) Phase I and Phase II. Teacher C is also active within the CSE community and has shared resources and experiences with the broader community. Teacher C is now receiving CPD from the PDST to bring Computer Science to Senior-Cycle students in the school. This, along with his commitments to act as a part-time Associate with the JCT, has meant that his time has focused on CSE within his school over the last few years. As mentioned earlier, the schools' approach to ICT has been commended within numerous reports; the school has also made efforts to increase the schools capacity. As part of these two additional teachers from within the school, were asked to engage with the JCCiA Phase I of CPD, from 2017-2019.

Teacher D was one of the teacher within RCS, who received CPD as part of JCCiA. He has a Bachelor of Technology (Education) in Materials and Architectural Technology, after achieving his teaching qualification; he worked in different education settings before securing his position in RCS. As a practical teacher, Teacher D, like Teacher C, had a classroom where most of his classes were based. He was part of cross-curricular projects within the school and engaged with extra-curricular activities within the school. As a technology teacher, he was excited by the prospects of the subject. During the interview, he mentioned the multiple benefits of the subject for his students, 'a whole skill set that is not just specific to this subject' but also provides students with computational thinking skills that can be used in 'all subjects and areas of life'.

Teacher C and Teacher D worked with two other teachers as the 'Coding/CSE/ICT department'. The team was responsible for managing introductory and intermediate level computing, technology and digital media courses. The introduction of a short-course in Coding at lower-second-level has been proposed for several years, with Teacher C acting as the coordinator within their schools, developing and delivering courses since 2007. In September of 2015, Teacher C. brought the Coding short course into the classroom. In 2017, Teacher D took several Coding classes and was delighted by the positive response from students. However, he wished to expand his knowledge of programming and pedagogical skills before expanding his school role. In 2018, he began studying Coding and Computer Science at his local Institute of Technology. This flexible course has several benefits in terms of working hours. It is challenging, requiring teachers to set aside time to learn after the workday and attend on-site days on the weekends. In September of 2020, he is hoping to start teaching Coding, and while nervous, he is excited by the prospects of implementing the pedagogical strategies that he has learnt over the last few years of CPD. During the interview, both teachers reported the critical benefit they observed was improving their confidence in the short course material and content.

5. 3. 5 Students of RCS

Demographics were gathered on students attending RCS; over seven hundred students registered within the school with an almost even split between male (47%) and female (53%) students. While the school has a rural setting, the student's cohort is drawn from both urban and rural areas. The student population's diversity is also reflected in its ethnicity, with students from over fifty distinct cultures attending the school. Students who took part in the survey were either in their second 57% or fifth year of second-level education 36%, a small number of the students were in transition year. Male students made up 70% of respondents, while the remaining 30% were female.

Table 17 RCS Student Demographics

Year Groups	**Percentages of students in each year group**
Second Year – 2nd year	57.1%
Fourth Year – Transition	7.1%

Fifth Year – 5th year	35.7%

All students who took part in the survey had a minimum of twelve months of experiences with the short course in Coding. While within the school, the divisions between the students who had prior experiences were almost equally divided into the three categories, as shown in Figure 19.

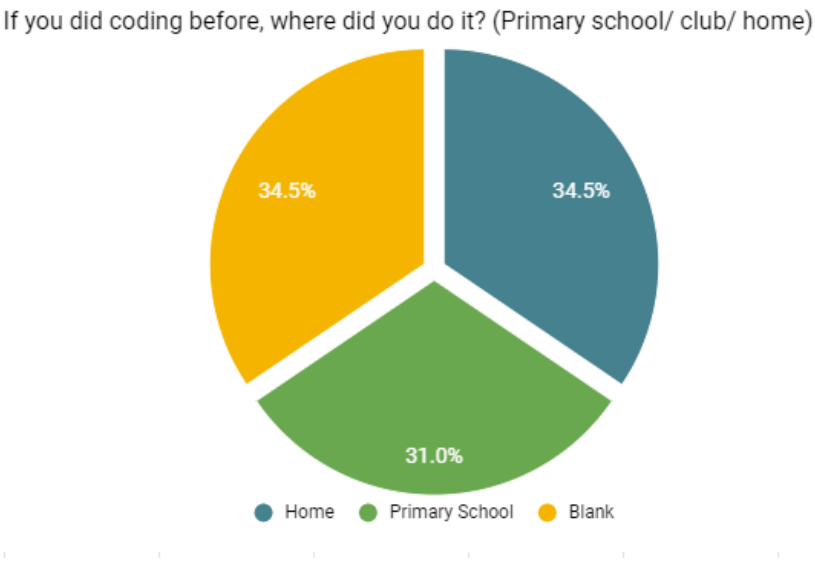

Figure 19 Student Prior Experiences

Students had a wide range of experiences and perceptions of the short course in Coding. Most of the students expressed their 'interest' and joy for the subject. When sentiment analysis was applied to students' qualitative responses, they were found to be neutral (+0.25) with a magnitude of 18.27. A word cloud was created from the responses of students of RCS. The size of the words increases based on the rate of recurrence within students responses, as shown in Figure 20, the overall responses of students were positive.

Figure 20 Student WordCloud_RCS

Within RCS, the student's qualitative responses were also analysed to uncover if patterns existed within students responses. As can be seen, the students' qualitative responses to the questions asked, students were very positive when it came to the short course. When keyword analysis was applied to the student, responses were explored, the following words appeared in Table 18 below.

Table 18 Key Words Analysis

Girls	Boys
enough class	difficult task
explain things	students
lot of details	amount of coding
everyone	teachers
smart device	short course
Computer Science	lot of ways
fundamental technology	lot of learning
related things	opened many possibilities

Student's responses were also divided by gender, due to the sharp contrast in the language used by female and male students. Female students viewed the short course within the current learning context and spoke about the relationship between Coding and other elements. Male students focused on the challenges and broad nature of Coding and also highlighted the possibilities.

5. 3. 6 Lessons from RCS

Below an outlined of the key lessons, which can be learned from this school:

- Teachers attempting to engage in extensive CPD need days to be outlined well in advance so that lager schools can plan well in advance;
- Structural reforms have to be supported by pedagogical reforms;
- School management and administrative play a critical role;
- Teachers in such schools require support from fellow teachers to avoid burnout;
- Individual teachers, should not be expected to act as an individual within their schools but rather as part of a team;
- Providing opportunities for teachers to engage in critical reflection are critical for maintaining a focus on pedagogy rather than behaviour in such schools;
- Valuing of teachers is necessary for improving teacher morale and continuity of initiatives;
- Factors outside of school, can have a considerable impact on students in school and the resources of the schools should be utilised to support these students;
- Positive relationships between teachers and students are essential for engaging students in a new area of learning;
- Students with anxiety or additional learning needs are dependent upon explicit criteria being made available to them, such as assessment criteria;

Availability of resources outside of the schools setting is a particular issue facing students and teachers in this school.

5. 4 Teaching & Learning Coding

The section will address each of the research questions with data gathered from both case schools; comparisons will also be made between contexts. It is divide into four parts, which, in turn, will focus on the below research questions:

1. What are teachers' perceptions and experiences of implementing the short course in Coding?
2. What are students' perceptions and experiences of learning in the short course in Coding?
3. How is the short course on Coding being implemented in the two schools?
4. What similarities and differences are observed between the two schools, and what can be learned from this comparison?

5. 4. 1 Teachers' Perceptions and Experiences

There was a 50-50 ratio of female to male teachers who were interviewed. Teachers whom this research is concerned with here are people who happen to be teachers. Teaching is their professional occupation, for which they are paid, what has motivated each of them to enter the teacher, the profession is varied and multifaceted. Additionally, their reasons for teaching CSE are complex. Their decision to engage with CPD is both a personal and a school-level decision, which needed to be supported by management within the schools. Within the school, there were several elements, which influenced the day-to-day development of professional practice. Teachers were encouraged to develop an understanding of theoretical concepts and develop skills through practical work, projects, and teacher and student lead explorations. Teachers training time: Each of the interviewed teachers had engaged in formal CPD training since 2016. Teachers received formal training from the JCT, but as Teacher D indicated, for those, there was a strong desire to engage with additional training and upskilling outside of the CPD. It was promising to see each of the teachers' commitment to attend CPD events and encourage the skill acquisition and development among fellow teachers. All four teachers also had to find time for additional training meetings and (S)LAR meeting outside of timetabled classroom hours for both Coding and their other subjects. These meeting placed additional strain on the teachers involved; however, they were also necessary to their practice and provided them with support and time to speak with collogues about students’ progress. Thus it is clear, that there has been significant reform to the structure, content, and

assessment at lower-second-levels, in each of the case schools. These changes have been profoundly experienced by students and teachers who interact on the frontline of education.

Concerning advances in teacher competence in computing, we have seen that like a student, the teacher's confidence increases following engagement with the CPD provided by the JCT. They felt as though the CPD they received gave them more than just the information, but provided them with time to create, collaborate and explore innovative approaches to teaching the Coding short course.

5. 4. 2 Students' Perceptions and Experiences

The student's survey in each school indicated some of the implications, which students have had since Coding's introduction. Student feedback gathered in two schools, 44% of responses were from school UCS, and 55% of responses were from School RCS. 80% of students answered all the survey questions, with strong similarities in both schools' qualitative responses.

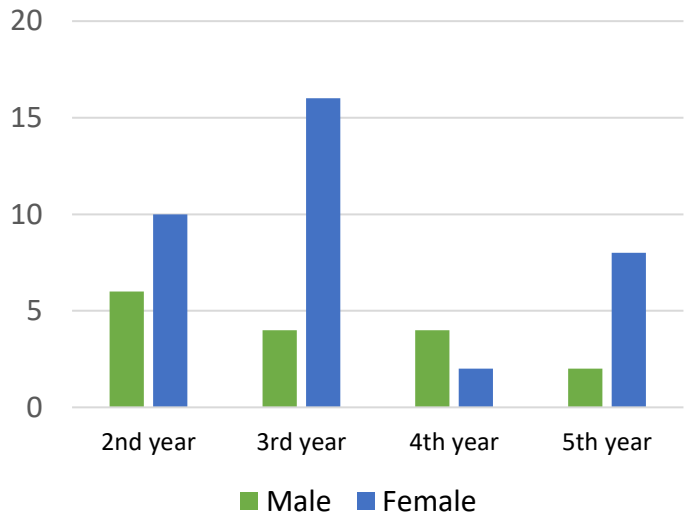

Figure 21 Breakdown of Students by year and gender

Amongst all the students surveyed, there was a consensus that the course was positive, with 95% of students enjoying one or more aspects of the course. 70% of students wanted to learn more about Coding topics. The three main findings, which were uncovered following analysis of the student responses, were as follows:

- There was a difference in the way male and female students spoke about Coding.
- Student previous experiences of Coding had a profound impact on their confidence levels.

- The short course has had a positive impact on students.

While there were, other responses, which focused on specific elements of the course, or the school setting, it was evident that communities existed both across and between the school settings.

Table 19 Student Experiences

Students who completed the short course in Coding with no previous experience in Coding but would like to learn more:	55%
Students who had previous experience of Coding at home:	72.7%
Students who had previous experience of Coding in Primary School:	69.6%

The data tells us that those who completed the short course and had no other experiences or exposure to Coding 55% wanted to learn more about a topic, which they had looked at while completing the Coding short course. Of the remainder, 30% said no, while 15% were still undecided, these students were in 2nd year, and perhaps this could be the reason for the undecided position.

UCS faces many of the challenges of other schools in low socioeconomic areas. It is a complex school with a range of teachers, some of whom have admiration for the students and are committed to making a difference in their students' lives. However, some other teachers have slipped into a 'survival' mode that is accompanied by discourses of deficit regarding the community, parents and students. It would be too easy likewise to adopt a deficit model of such teachers. The school community does face challenges brought on by violence, poverty, racism and social dislocation. However, for many of the students who attend this school, as indicated by the deputy principal, it is perhaps the 'last chance' for them. As such, the quality of the education provided is crucial for their engagement with the world beyond the school both now and in the future.

Students across both school settings were asked if they would be interested in learning more about any of the topics they explored as part of Coding's short course. The response rate to this question was 51/55. This case study found that 95% of Students enjoyed one or more aspects of the short course and that the more

engagement students have with computing, the more likely they are to want to learn more. When students were asked if they want to learn more:

- 73% of students who had experiences of coding at home wanted to learn more.
- 70% of students who had engaged with Coding at primary level wanted to learn more.
- Moreover, of the Students whose sole experience was the short course in Coding: 55% wanted to learn more about Coding.

What this tells us are that time matters. When students understand computing, its challenges, and the advantages, they are more confident and see themselves studying it in the long term. Of the remainder, 30% said no while 15% were still undecided. All the undecided students and had no previous experience were in 2nd year, as they still had several topics left to cover as part of the course this could be a reason for the undecided position. The undecided student who had experience at home was a 5th-year boy; he did not give any reason for his answer with respect to this question.

The students were asked if they wanted to learn more about coding. Of the 29 girls who took part in the study, all answered the question with only 46.4% saying that they wanted to learn more about Coding while the majority at 53.5% stated that they did not wish to learn more. The girls gave a variety of reasons for their stance, with most stating that they had a lack of ‘interest’ or were unhappy with the ‘topics’. One stated that coding was not her ‘best subject’, and another wrote ‘In the future, I do not think I will do anything with coding’. Of the girls who reported that they would like to learn more about coding the most common answer (54%) was to ‘create games’. Six of the girls compared the course to other topics or skills that they had.

Interest/ Application of Coding	Content/ Creative aspect	Confidence/ Achievement
I would like to know how they **apply to our everyday** lives. I like coding and this short course was **very interesting and engaging.** **Games and Computer Science** learn more **about computer science and coding.**	**Games** **Games.** I would be interested to learn more about **creating games** and have a better **understanding of how to create them.** **Javascript,** I find it interesting to type rather than using blocks in scratch. I learned that I **enjoy making websites** and I would like to learn more about coding websites. I really enjoy **creating games**. I would like to learn more about **Photoshop and game code** I would like to learn more about **Games development and design.** I learned that **I enjoy making** websites and I would like to learn more about coding websites.	**Like programming** and want to do more.

Figure 22 Girls Responses

Of the twenty-five boys who agreed to take part in the study, three of the responses were excluded when compiling the data, as they did not answer any of the questions in the survey. 100% of the boys who completed the survey stated that they would like to learn more about coding. They all had different specific reasons, but almost all the mentioned games. The boys who completed the survey stated that they were happy with the short course content and structure. One of the boys even stated that ‘the short course was interesting and engaging’. The boys used words like ‘solving’, ‘control’ and ‘potential’. They had a desire to ‘learn more’, ‘to code better’ and ‘to find out’. Another stated, ‘I am interested in computers and how they work’.

Interest and Engagement (General)	Programming (Skill Development)	Creative
I like coding and this short course was very **interesting and engaging**. I would like to learn more as I feel it is **interesting** I am **interested in computers and how they work.** I would like to learn about it more because **its interesting** at times. I would like **to know more.** *Yes as it has **great potential** Yes, I **enjoy technology.** I **enjoy** the course and I have a keen **interest** in the course.	Like **programming** and want to do more. I'd like to **know how to code <u>better</u>** in python and JavaScript. I would like to find **out <u>more</u> about python** You get to see what **programmers do.** **Solving** code in scratch, I'm really interested in learning about **computer science and programming**	I would like to learn more coding so I can **create games** in the future. I would like to **create games, apps etc.** I want to be in control. I want **to make games.** I would like to **get into game** code.

Figure 23 Boys Responses

Students of RCS were divided on the benefits of the course being options, with one feel that having the autonomy to select the subject resulted in students being more open-minded 'If people want to do it they should have an option'. In contrast, others felt that teachers involved in the study have all been involved in CSE or ICT education since beginning their teaching careers. Interestingly, in the school where the subject was optional, a higher proportion of students felt that it should be a compulsory subject. One student of RCS stated that they felt that 'everyone should have a chance to enjoy Computer Science and realize how fundamental technology is' (Student 15). While another stated, 'everyone should know how to Code' (Student 9).

In USC, Coding was a compulsory subject, which all students at lower-second-level were timetabled to study the course. A decision has been made to adopt the subject selection of subjects from September of 2020. For students in UCS, they were divided on the position of Coding within the school, with some arguing that 'some students may not know the value of coding and how important it might be when their older' (Student 11), while another stated:

> I just feel as if it is not needed or useful in Junior Cycle. There is nothing you would take from the coding course and apply in real life, making it un-useful. This course is not for everyone (Student 30).

Students from both schools, possess a strong desire 'to learn more', 'to code better', and 'to do more' programming, robotics, and real-life problem-solving. This research study found that 95% of Students enjoyed one or more aspect of the short course and that the more engagement students have with computing, the more likely they are to want to go onto to learn more. When we asked students if they want to learn more: 73% of students who had coding experiences at home wanted to learn more. 70% of students who had engaged with Coding at primary level wanted to learn more. Moreover, of the Students whose sole experience was the short course in Coding: 55% wanted to learn more? What this tells us are that time matters. When students understand computing, its challenges, and the advantages, they are more confident and see themselves studying it in the long term.

5. 4. 3 Implementation of the Short Course on Coding

Both schools have adopted the policy, to match the needs of their students as well as maximizing the provision and impact of CSE. RCS offered the short course as an optional course with student's timetable from the first year. While RCS decided to offer Coding as a choice, which their students could choose, often placing it in opposition to Digital Media Literacy, most schools within the JCCiA positioned it as a compulsory subject, which all students were required to complete. In UCS and RCS, Coding was a core element of the timetable for all students in lower-second-level, when it was first introduced. However, both altered this approach. The motivations behind this decision were numerous, firstly the increases in timetable hours required for *Wellbeing* and to receive certification in short courses. The *Wellbeing* programme began with 300 hours of timetabled engagement in 2017 and builds up to 400 hours by 2020 (Ireland. Department of Education and Skills, 2018). Secondly, schools can only offer students a maximum of four short courses in the JCSP, with a wide variety of short courses to choose from schools wished to expand subject offers to students.

Field notes were taken during the school visits and maps of the Computer Science classroom, and images of the inside of the classrooms can be seen in Appendix IV. In RCS, the Computer Science classroom

was located in the school's main building, opposite the administrative office and entrance hallway. The computer rooms were well equipped with shelves and cabinets filled with resources around the room, with a midi-tower desktop computer attached to a monitor, mouse and keyboard lining the classroom walls. Round tables at the centre of the room provided space for unplugged instruction and project work. One of the primary aspects, which required a great deal of time and organisation, was the storage of resources. As the ICT coordinator within the school, Teacher C, was responsible for enacting ICT policy and the distribution of technological resources within the school. Figure 24 provides an insight into the method of resource storage within the school. On the top-left hand side is the chrome books stored in a locked cabinet, which also acts as a charging station for the chrome books. There are also class sets of iPads stored in soft portable bags for ease of transport.

Figure 24 RCS Resource Storage

Within RCS, Teacher C is primarily responsible for the acquisition and safekeeping of this equipment, which can be difficult when the teacher is away at CPD events. While within UCS, there appeared to be a greater distribution of responsibilities when it comes to ICT. There were also class sets of iPads and other resources shared across subjects and departments within the school. Rather than being tied to any particular teacher or room, the resources were stored in administrative offices and general areas. There is also access to computers in the Library, as seen in Figure 14, on the right. These computers can be accessed by students who wish to complete projects outside of the class setting (see Figure 25).

Figure 25 UCS Storage

The software, which students engage with, is for the most part, free and open-source, the reasoning behind this is multifold. Firstly, the software tools are available to students at home as well as at school. Secondly, financial status was outlined as something that should not impact students' ability to learn in either school. Substantial efforts have been made to alleviate disadvantage among students. Thirdly, it allows students to examine the source code of the tools, which they use. Welcoming communities of programmers typically develop open-source software, and it was deemed positive for students to have access to such communities. This prepares students to engage with the tools, which they use as well as have an impact on their applications and features. Finally, open sources software empowers users to impact and develop their tools rather than merely being users or consumers of software; they are developers. This engagement with the external sources and resources was recommended within the specification for the short course to ensure students understand that they can positively impact the world around them. This is also in line with the educational plans of both schools in the area of student well-being. Students and teachers occasionally viewed the Coding short course as a way to address student safety. The appropriate use of computers was emphasised and was a common topic explored by students taking the course in both case schools.

5. 4. 4 Similarities and Differences

Over the past four years, students in RCS and UCS have designed, wrote and tested code, within Irish classrooms software programmes, websites, animations, apps, and games have all been developed by students. Both students and teachers have had the opportunity to explore learning areas such as robotics, digital media, and writing in programming languages such as JavaScript and Python.

1. Students with the most prolonged exposure to Coding topics had a stronger desire to go onto further study in this area.
2. Teachers were primarily motivated by an intrinsic desire to equip their students with Coding skills.

Both teachers and students felt that they had grown in confidence and knowledge since their first interactions with the Coding specification. Alongside this, it uncovered that the use of external stimuli encourages discussion and development of new idea. Further discussion of the schools' similarities and differences will be explored in Chapter Six.

Chapter 6 Discussion of Findings

The research questions were designed to provide an insight into Coding with schools. Within this chapter, we will look, both 'within and across' each of our case schools, and endeavour to address each of the research questions.

6. 1 Attitude towards Coding

Now that the data gathered each of the case schools has been presented, see Chapter Five, the research questions will be explored, each case's nuances explored. This part of the chapter will attempt to answer each of the four research questions outlined in Section 1 concerning our case schools. Discussions will focus on the *desirability*, *justness, effectiveness*, and tolerability of Coding within each case study (Kerr, 1976). Kerr discusses how to conceive and understand the policy and sets out each of the four lenses through which a policy can be examined. According to Kerr, there are clear criteria which are needed for a policy to be successful desirability: is the policy desired, justness: is it perceived as a just policy, effectiveness: has the policy been seen to make the changes, and tolerability: is it sustainable and treated equally across/ between settings (p.352-4). Within the next section, each of the following four research questions will be explored through the lens outlined in Donna Kerr's (1976) writing, as seen in Figure 26.

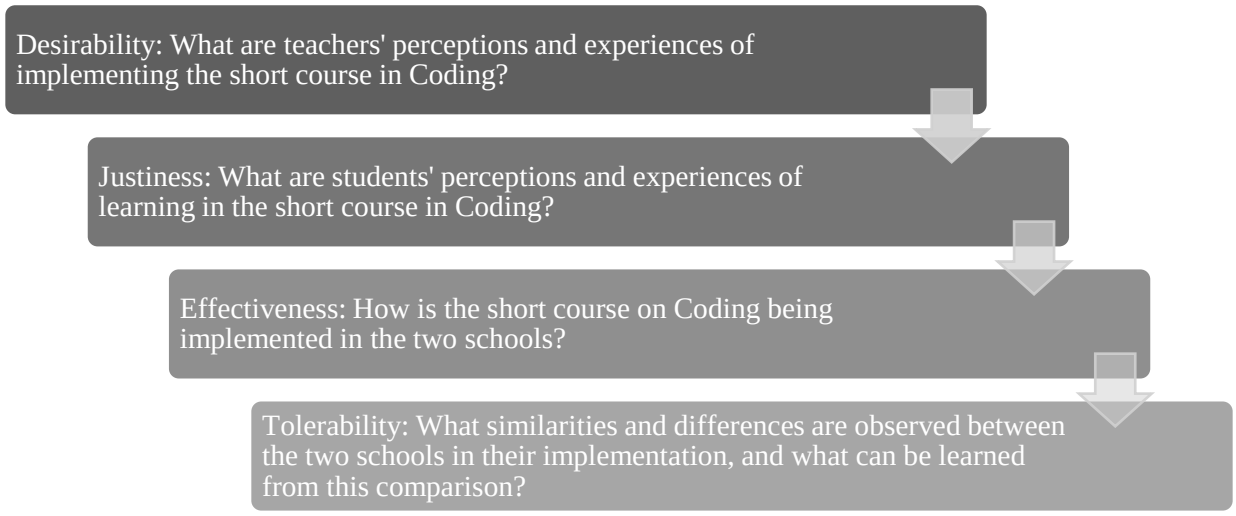

Figure 26 Attitudes towards Coding

6. 1. 1 Desirability

Discussions within this section of the chapter will focus on the short course's desirability in Coding, among local actors. The question, which it hopes to answer, is teachers' perceptions and experiences of implementing the short course in Coding? Having outlined the Irish education system in section 2.3 and discussed the teachers' background, in 5.2 and 5.3, the research explored the Coding short course specification's local opinions. Within this section, the researcher analysis this desirability of the course within our two specific schools. It is beneficial to understand why teachers and students, for whom the short course is optional, deem it desirable.

The primary objective of reform at lower-second-level was for students to complete an inclusive curriculum and to develop the knowledge and skills that will allow them to proceed to Senior Cycle education having gained a comprehensive education (Ireland. Department of Education and Skills 2020). It is a student-centred programme of study involving a cross-curricular approach and a focus on skill development. At the centre of Junior Cycle reform lies the need to construct on our understanding of education, and to promote active and collaborative learning that will allow for a better balance between the development of subject knowledge, and the development of essential life skills and thinking abilities (Ireland. Department of Education and Skills 2012, p. i). In the government publication titled 'A Framework for Junior Cycle,' the decision behind the reform was to '…enable schools to offer their students a three-year Junior Cycle experience that is both a progression from primary education and preparation for the Senior Cycle' (Ireland. Department of Education and Skills, 2012, p. 1). From the beginning of this reform, it was envisioned that CSE would be included, in some form. In the Irish government's Action Plan for Education 2018, one of the commitments made was to the acceleration of an ICT agenda in schools; this was to be achieved through the JC short courses in Coding and the introduction of the Senior Cycle subject of Computer Science (Ireland. Department of Education and Skills, 2018, p. 76). Incorporating the Coding short courses as an optional element within the school, timetable offered unique challenges and opportunities.

Over the past decade, both schools have made great strides to keep up-to-date with the extensive progress and updates within Ireland's Education system; these changes have been grounded in the

constructivist teaching and learning model. There was a move away from teacher-led towards the teacher as the facilitator of learning model at Junior Cycle level. Examining the motivation behind any policy's introduction can help us understand why and if it was viewed as desirable at a local level. Both top-down and ground-up motivations were observed behind the introduction of CSE in both schools. Within school descriptors of the short course in Coding, it was described as a course designed to equip students with the skills necessary to participate in society fully and secure employment. This is in line with the modern and innovative approaches to learning outlined within both schools websites and prospectuses. This highlights the understood symbolic value which inclusion of innovative optional curricular subjects and courses present. The introduction of the short course in Coding can be seen as a symbol of possibility. Its status as an examinable subject differentiates it from traditional ICT or computing modules at this level.

When asked why they decided to deliver the short course within his school, each of the teachers gave different reasons. Teacher A felt that the specification offered a clear pathway for students to learn about Computer Science. Teacher B's decision was based upon her connection to Computer Science and the connection to the student learning in this area. For Teacher C, the decision was simple 'Because it is there'. When asked to expand on his motivations, he stated that he, like G. Mallory, was motivated because the course provided him with an adventure path and to explore his limits (Anker, 2001). While for Teacher D, he was excited by the benefits of the policy for his students. He felt that the course was desirable as well as necessary for students to develop skills 'for the future'. Many of the students surveyed echoed Teacher D's sentiment; they were excited by the prospect of the skills they may acquire within this new area of learning. As noted in chapter two, ICT and technology-focused, CSE was offered informally within some schools. This was true in both of our case schools. However, the primary difference observed by local actions (both students and teachers) was that Coding provided an opportunity to learn programming while acquiring computer science knowledge and developing critical skills.

Thus, we can see that within both case schools, the short course was desirable by local actors. While given its position within the school's timetable, it can be deduced that it is desirable by the school management.

6. 1. 2 Justness

Discussions within this section of the chapter will focus on the justness of the short course in Coding, among local actors. The questions, which it hopes to answer, is what are students' perceptions and experiences of learning in the short course in Coding? Within this section, we are concerned with the justness of the policy for teachers and students. The feelings of both students and teachers towards the support they have received as they approached this new area of learning can significantly impact whether the policy is viewed as *just* or *unjust*. In addition, the level of autonomy that local actors have towards the adoption of a policy can influence its perceived *justness*. The finial is the local enactment of the policy; does the construction of the policy facilitate the inclusion of all students? Do students see it as being for some or for everyone?

The students enrolled in each of our case schools, learning and education, are radically different from their parents and guardians. These students have been labelled as 'technology natives', however, for many, especially students from disadvantaged backgrounds technology is not something which they have an inherent understanding of how it operates and how it can be utilised. This is supported by Bennett and Maton's, who caution educators to be aware of when teaching students (2010). This is an issue which the Junior Cycle short courses in Coding hope to address. The presence of these short courses as part of the reformed Junior Cycle level means that for the first-time students will be given a formal introduction to Computer Science within their Junior Post-Primary education (McInerney et al., 2016).

The teachers whom we are concerned with here are people who happen to be teachers. Teaching is their professional occupation, for which they are paid, what has motivated each of them to enter the teacher, the profession is varied and multifaceted. Additionally, their reasons for teaching CSE are complex, and their decision to engage with CPD is both a personal and a school-level decision, which needed to be supported by management within the schools. While it is evident that the teachers had a variety of experiences of enacting the short course, each teacher expressed positivity towards the introduction of the programme and its open and broad scope. They had previously acted on their school-based programmes as individuals. The Short Course in Coding had facilitated 'building capacity' and 'understanding' for CSE within the school (Quote form Teacher A).

The addition of the Coding short course, to the school timetable, encouraged teachers to move out of their disciplinary silos to work alongside others to pursue goals outside of their traditional subject area. As a new area of learning, all teachers approached it with the same understanding, although some had strong technical and pedagogical knowledge. The professional development supports provided by the JCT were designed to aid the adoption of the course across a wide range of educational settings. These supports began in 2013 and are expected to continue until 2022. In 2015, a joint report from the TUI and the ASTI the two largest teacher Unions released a joint statement in response to the proposed reforms to Junior Cycle. In the statement, they acknowledged that in order for the reform to be successful teachers would require:

- Support for professional development and collaboration;
- Timetable provision for meetings and other collaborative activities;
- Recognition of learning and engagement;
- Reduction of focus on one terminal exam as a means of assessing students;
- Greater professional collaboration between teachers to be a feature of our schools

In addition to professional development, exemplar materials and online support would be provided to assist the *just* introduction of educational reform (ASTI, 2015, p. 12).

Both students and teachers' feelings towards the support can significantly impact whether the policy is viewed as *just* or *unjust*. When questioned on their feeling about the support they received, teachers were positive. Why asked about the impact which receiving support from the JCT has had on their practice, teachers had a positive experience. Teacher A stated that the variety of ‘activities, hands-on learning-practical and effective tips and advice’ received were highly beneficial. For Teacher B, the ability to network with others and receive time for formal support. While Teacher C, did not feel that the support had an impact on his teaching, however, he did feel it was necessary and aided in the adoption of the subject. Finally, Teacher D enjoyed the professional support he received; he hoped that more engagement with professional development programmes would help him to develop as a practitioner.

Students also had various experiences when it came to their experiences of the short course in Coding within each of the schools. While for some, the course was compulsory, most had the option to study the

course. For students, while some found the option of studying the course gave them a sense of autonomy, it was evident that students were undecided on whether the course should be for all or just for those who wish to study it. This differential was sensitive to the year group and prior experience of the students. Most of the students who felt that the subject should be a subject for all students had prior Coding experiences at primary school or home. The justification behind their stance was the benefit of the 'skills' acquired within the Coding course. Students, who felt the course should be optional, can be divided into two separate categories. Firstly those who felt that students should have the autonomy to choose their subjects (as a general standard). Secondly, those who felt that Coding as a specific subject is not 'useful', 'interesting', or 'needed' by everyone. The level of autonomy which student has towards the adoption of a policy can influence its perceived *justness*. However, as our case schools revealed, the course's perceived justness is linked to students' prior experience. Thus, it is clear that within the case schools, the policy was viewed as *just* due to the flexibility with which schools were able to introduce the reform and the supports and mentorship, which have been given to both teachers and students.

6. 1. 3 Effectiveness

The effectiveness of any policy is as complex and subjective as it is difficult to measure. While authors have proposed several methods for measuring policy effectiveness within this case study, we have asked the local actors if they feel that the vision of the policy has been effective within the context of their educational environment. This section hopes to answer the questions; is how the short course in Coding being implemented in the two schools effective?

According to Fullan and Hargreaves (1992), staff development is a core element of innovation and change within educational settings. Learning opportunities for teachers, involved in the short course in Coding are underpinned by robust evidence and expertise of educators and researchers, sustained over a two-year period, focused on practice, include collaboration and sharing of practice (Fleming & McInerney, 2019). According to the Department of Education and Skills (2016), change in education is more likely to be effective when prioritised and encouraged by school leadership (Ireland. Department of Education and Skills, 2016). Where professional learning does not work, it is often attributed to the fact that it does not consider student

learning. It underestimates the power of habit or built on an inadequate theory of pedagogy' (Coe, 2017). CPD schedule is too often dominated by the exploration of 'what' over 'how'. Research shows that 'you can change teachers' thinking about something' through workshops, presentations, and research engagement, 'without changing what those teachers do in classrooms' (William, 2007). It is a vain attempt to focus on teacher learning unless it leads to change that influences pupils' learning. In line with this, teachers we asked to outline if they had changed their practice or developed due to the policy reform's introduction. While two of the teachers stated, their practice had not changed or was only altered limited fashion. Two of the teachers express a profound change to both their professional practice since the policy change in this area. Three out of the four teachers were currently teaching the short course, at the time when the data was gathered. It is difficult to say that any policy is effective; instead, it may be more accurate to say that this research has discovered that within the context of our case schools, this policy has altered the practice of some. However, more than policy change influence that changes within this area.

The opinions of teachers towards the policy, along with a multitude of other factors, have the ability to influence their practice. This purpose of policy change can often align with the school's aims, the department's focus, or the teacher's areas of interest. Sometimes, a teacher's feelings towards reform are driven by results. Each of these alignments can be damaging to the development of a culture of professional learning unless it is also firmly focused on matching pupils' needs. The teacher will struggle to develop strong self-efficacy, where they can identify the impact their actions have on their pupils' learning. As Balanskat & Engelhardt (2015), proposes for learning to be successful, it must be woven like a golden thread within our own understanding, connected to others and motivated by a purpose or desire. Learning out of field may well create cognitive dissonance for teachers as it challenges their existing beliefs (Sentence & Csizmadia, 2017). For Teacher D, this was clear as he felt 'outside' of the CSE community. Through engagement with professional learning cultures, outside of formal JCT supports, he began to gain confidence and embrace the opportunities presented to him. This journey is consistent with what was discussed in the literature review. The 'consideration and effort' of exploring learning outside of formal supports are 'more likely to lead to change' (Wiliam, (2007). According to Wiliam (2007), educators will struggle to challenge their beliefs without the help of an external

stimulus such as a professional development programme, peer mentorship, research programmes, or other expert input (Wiliam, 2007). For the educators who already viewed themselves as experts within their field prior to the introduction of change, this shift is perceptive is less pronounced or may not occur. However, these experts are more likely to act as leaders within their community and their schools.

6. 1. 4 Tolerability

The questions, which it hopes to answer, is what similarities and differences are observed between the two schools in their implementation, and what can be learned from this comparison? As Bell et al. (2014) contend, context is 'sophisticated, contingent, complex and unstable' (p. 3). The question which this section, hopes to explore is 'is the policy resource-sensitive? Is it viable in the context for which it is designed to operate?' Teachers from both schools stated that they felt supported by management and other staff within the school. The journey, which these schools have taken to adopt this policy within their schools and to develop and purchase resources, is outlined below.

As noted in Section 2. 2, prior to developing policy relating to Coding, CSE at lower-second-level was focused on understanding and using technology. This new subject area's information gap is an expanding problem since a significant shift within this area has occurred. Closing this gap is a multifaceted problem. It requires substantial legislative effort to include CSE in the curriculum and at a national level. Moreover, it demands a mental shift in students, teachers and school administrators, making them recognise the importance of time for the development of pedagogical practices and resources. Furthermore, it needs a considerable teacher to know how to be integrated effectively.

Integration of technology has been seen within both schools, both of whom have multiple computer rooms, as well as sets of iPads, RasberryPis, micro bits and other devices, which can be rented for class projects see Figure 24 and Figure 25. As outlined earlier, their motivations were varied but reflective of wider desire as outlined in 2.1.1. Analysis of the local case, it was evident that a critical motivational factor was a desire to equip students with both hard and soft skills, which they could utilise across the curriculum and into further study. This was reflected in teachers and students understanding of the short course.

Each of these issues, while complex, did not restrict the decisions of the teachers who were interviewed to want to teach Coding. However, for Teacher D, he was cautious about teaching the subject without having gained professional qualifications within the subject domain area. However, having commenced his journey towards achieving this qualification, he expressed some regret at not having been more confident in teaching the course. Teacher D is typical of those who are encouraged to take up the subject; it is worrying that despite receiving CPD, he still felt uneasy about teaching Coding. However, this was not seen with Teacher A, who comes from a similar background, and stated that she has grown in confidence with teaching the course over the last two years. There were two distinguishing factors between these teachers; firstly Teacher A was given Coding on her timetable from the beginning while Teacher D, was not. Secondly, Teacher A noted the support and encouragement she received from within her school as critical to the development of this confidence, while Teacher D was perusing external professional development.

6. 2 Research Findings

While being respectful of the multiple and competing accounts, this chapter's specific purpose is to outline how Coding has been enacted within each of the two schools. Bansel (2015) argues that the norm within the school context is regulated by and is the result of 'relations of power and technologies, rationalities and ambitions of government that are coordinated, materialised embodied and enacted through the organisation of narrative' (p. 184). Educational researchers are often accused of examining education as an inspector might examine a crime scene rather than a critic would examine art. It is not an easy task to create a new area of learning for students; it is often an even greater task to receive support for such a change. While this research at the University of Limerick is focused on advances at Junior Cycle, this research will undoubtedly have an impact on not just students between the ages of 12-15 but across the educational paradigm. Schools, teachers and students faced three main challenges: they sought to enact Coding policy within their respective schools.

Timetabling of the short course within the school timetable is one aspect which was mentioned by students and teachers, within both schools. Untimely, school management decided not just who was going to teach Coding but who was going to study Coding (all students or some students) and ensuring that all who did would receive recognition by completing the 100 hours). Schools incorporated a short course into their timetable for

the first time and additional time for management, and the secretarial staff was needed to do this. In addition, as seen, each of the schools have seen the expansion of resources in four key areas:

- Staffing, short term cover for CPD and long term planning of subject provision.
- Room allocation, Coding classes required physical spaces for learning. The question being asked by management was will this class need the computer room or could they be placed in a standard classroom.
- Pedagogical resources, technological resources- computers, microbits and hardware, and resources to support learning. The development, organisation and storage of these resources add considerable workload to teachers.
- Greater communication between teachers and management, teachers and collogues, students and parents, as they adapted to changes in assessment practices, teaching practice, technologies, and resources.

There were considerable changes to assessment, with Classroom-Based Assessment being introduced. Students particularly felt these changes as they saw changes to their timetable, assessment, and the dynamic of classes, move towards projects work, collaboration and student presentations. Central to teachers' development through educational change is the nature of the school's professional learning culture and the constructivist approach to learning (Biesta, 2009). As stated in chapter three, research indicates that school culture and approach to learning have implications for teacher development, policy effectiveness and individuals' longevity in the profession. Both of the case schools stated their desire to strive for a culture that supports and sustains rather than one that restricts teachers is multifaceted. The nature of CPD shapes learning cultures, but it is not the only factor to consider. The conditions for learning are co-constructed by external factors and are developed and fostered within the school.

Concerning advances in teacher competence in computing, the case study has shown that students like teachers' confidence increases following engagement with the learning opportunities. They felt as though the CPD they received gave them more than just the information, but provided them with time to create, collaborate and explore innovative approaches to teaching the Coding short course.

When it comes to the short course in Coding, teachers received support outside of the school. Nevertheless, it was also critical that they had the support of school management and other staff within the school. Both the RCS and UCS had extensive support for the teachers assigned to teach the short course in Coding. There is frequently a false dichotomy, which premediates the international rhetoric and discussion around educational reform in the area of Computer Science; it imagines that CSE is pushed onto teachers (Fluck et al., 2016, p. 43). However, this research found that each of the teachers interviewed expressed their desire for the policy. The case study shows that substantial work has taken place in the development of enactment of the short course in Coding. However, there were some areas where schools and teachers have had to work hard to ensure that the Coding short course was a success for both the students and the school community.

6. 3 Assumptions of the Study

The author of this case study, recognise that several assumptions were made in advance of the commencement of the research and indeed, throughout the review and analysis of data. These are as follows:

1. That interview and survey questions are answered with honesty and integrity.
2. All participants have a sincere interest in participating in the research and do not have any other motives, such as financial or academic advancement.
3. The schools selected are appropriate and therefore, assures that the participants have all experienced the same or similar phenomenon.
4. That the supporting evidence which is publically available, about both case schools and the policies are accurate and can be trusted.

This study investigates local actors who have been impacted by the introduction and enactment of the short course in Coding. This research focuses explicitly on two schools who previously engaged with government programmes, provided by the JCT to support Coding's introduction (see Table 5 for details).

6. 4 Limitations of the Study

According to Taylor and Cranton (2013), studies that are carried out in the period of transformative learning are limited by both time and the availability of resources and personnel (p. 42). The following factors limited this study:

1. Time was limited, to the duration of the study.
2. The bias of participants, the two case schools, were involved in educational reforms, and so their feedback may be biased towards the success of the short course. Students may also be influenced by their overall experiences of education and could give overly positive or negative feedback dependent on their attitudes towards particular staff or education.
3. The number of participants is limited by the number of teachers and students involved with the short course in Coding within the school. Teachers and students are at the core of this study – while school management, administration and other actors were consulted, they did not actively participate in this study. Including these actors' perspectives would have required more time but may have shifted this study's focus.
4. It would be interesting to explore school administrators' perceptions of this additional curriculum component, especially within specific school variables such as timetable and resourcing this new subject area. This could shed light on the particularities of introducing Coding and help identify other challenges that may not be evident for teachers and their students. However, this type of exploration was outside the scope of this study.
5. Moreover, only two schools participated in the study. As this is a multiple qualitative case study, a small sample is adequate to provide in-depth information. However, to create a large-scale study with a bigger sample size on the same subject would help to understand this area in greater depth. More information about limitations concerning sample size and methodology are discussed in Chapter Four.

6. 5 Conclusion

The findings suggest that the policy is desirable and tolerable in each of our case schools. Some adjustments may be required to ensure that the policy can be defined, as being just there are some concerning trends when it comes to gender basis and teacher confidence. More work is required to ensure female engagement and the encouragement of teachers to teach the subject. Although the policy's effectiveness is still not apparent, from this research, it can be stated that the local actors who have taken part in this study report that they found the policy to be effective.

In addition, this case study has found is that teachers who are passionate about engaging students and deepening their understanding and love for Computer Science in all its forms. While this is often significantly differentiated across educational settings, most teachers share this desire. Bansel (2015) argues that the norm within the school context is regulated by and is the result of 'relations of power and technologies, rationalities and ambitions of government that are coordinated, materialised embodied and enacted through the organisation of narrative' (p. 184). It is not an easy task to create a new area of learning for students; it is often an even greater task to receive support for such a change. While it was evident that the overall numbers of students and schools selecting to study CSE had increased, as a researcher I wanted to understand why they had made this selection and what lessons could be learnt from the initial pioneers of this programme. I hope that I have done so clearly and concisely. The final chapter of the dissertation is Chapter 7, which presents a conclusion to this research project.

Chapter 7 Conclusions of the Research

This research provides an in-depth exploration of both teachers' and students' lived experiences to the Coding short course to improve teaching, learning, and practice. This concluding chapter of this research study has been broken down into the following four sections:

- The first section (7.1) reexamines the research overview
- The second section (7.2) provides an overview of the results of the research
- The third section (7.3) proposes areas for further research.
- The fourth section (7.4) provides a brief conclusion.

7. 1 Research Overview

The two case schools are similar; both are public secondary schools in the ROI that received support from the JCT, and they share a similar ethos and attitude towards innovation. This constitutes a comparative and international education study of 'Similar Systems – Different Outcomes' (SS-DO), described by Steiner-Khamsi (2013), which will be further examined in Chapter 4. The research questions are probing in nature and constructed to understand how Coding's introduction has impacted each school. In line with Kerr's (1976) writing, there were four aspects, which must be inspected to understand if an education policy is affected, these are *desirability*, *justness*, *effectiveness* and *tolerability*.

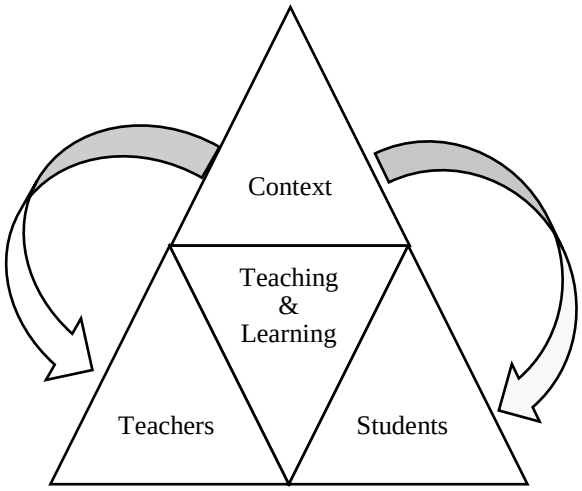

Figure 27 Triangulation of Data

7. 2 Results of the Research

This study's overarching purpose was to examine how local schools and local actors in ROI implement the comprehensive CSE through perceptions and enactments and the consequences of implementing this framework for teachers and students' professional autonomy.

According to Bell et al., within the area of CSE, there is both 'the opportunity and the obligation to learn from the experiences of early movers' (2014). Like most European education systems, ROI schools are multi-ethnic and multi-cultural, as our case schools exemplify. However, schools and their students are often preserved to compose of a homogenous indigenous population with schools being typecast as the embodiment of the invisible link between identity and region. Informants from both schools displayed similarities in interpretations and classroom enactments. The most prominent findings of the local enactment are therefore tied to subject dependability and durability.

Furthermore, the school initiatives of technological use to assess the Coding, and the development of interdisciplinary subjects to battle challenges with digital, technology-enhanced, and based learning gave a clear picture of possible enactment strategies in both case schools. There was a strong connection between how local actors perceived their proficiencies and how they approached the policy. Thus, while the Coding specification has provided a clear roadmap, teachers still have the autonomy to focus on student interest and enjoyment and are not restricted in their practice.

Question 1: What are teachers' perceptions and experiences of implementing the short course in Coding?

Answer: This question was answered differently by each of the teachers involved, form this we can see that generalisation around teacher motivation is not possible. In terms of practice, the teachers with the longest tenure of teaching CSE reported the least change while those at the beginning of their professional career reported the most change. At a micro-level, there has been a change to the daily lives of the teachers involved in the adoption of Coding. Teachers play a vital role in helping students understand and learn and provide holistic support to young people. Schools are often tasked with combat social disadvantage. As noted in Section 5. 4, teachers' experiences and the development of their practice can be seen. While each teaches, can into the CPD with their own set of unique skills

and attributes they have developed their professional practice and expanded their network. Teachers spoke positively of the Short Course in Coding and highlighted the experiences they had gained as beneficial for their professional practice and development.

Question 2: What are students' perceptions and experiences of learning in the short course in Coding?

Answer: The policy has led to changes in both students and Second-year students' perceptions about 'understanding' and 'use' of computers. Students in the fourth and fifth year spoke about 'interest' and 'application of coding skills to other areas'. In addition, teachers at the start of their professional career noted the change to practice, while those with more established practice spoke about 'expanding' practice and exploring interdisciplinary subject materials. From these responses, we can see that practice and perceptions are not fixed. Instead, they continue to evolve as both students and teachers spend greater time interacting with Coding. For students, two main results emerged from the research, firstly, that 98% of students enjoyed learning to Code and that prior experiences are a vital factor when it comes to student's confidence. The Coding short course was designed to expand students' exposure to practical, hands-on and problem-solving learning activities. Students from each of the case schools expressed that they had enjoyed the course and would encourage other students to take up the course. Simultaneously, they felt that teachers should allow for greater exploration of topics and project work. From the student responses, it is clear that that the course was *desired* and viewed by most students as both *just* and *tolerable.*

Question 3: How is the short course on Coding being implemented in the two schools?

Answer: In one school the short course was compulsory while in the other it was optional. However, it should be noted that the compulsory school have decided to make it an optional element for students for the upcoming term. This decision was made following extensive collaboration with both Coding teachers and discussion with parents and students. The justification for this move was twofold: firstly, students who wished to study other subjects should have the option to do so. Secondly, students will be more focused during classes if they elect to study the subject. In terms of timetable, a sample of students timetables can be seen in Appendix XIII. Most Coding classes were allocated to the Computer lads in each school so that students had access to devices. When this was not

possible teachers noted that it was stressful, but that they had developed resources and lessons for 'off-line' lessons.

Question 4: What similarities and differences are observed between the two schools in their implementation, and what can be learned from this comparison?

Answer: The main findings indicate that school culture plays a critical role in adopting policy change. Furthermore, teachers identified that supports both internal and external were beneficial. Education has a profound place within the public consciousness concerning education (Bansel, 2015). According to Bansel, teachers' capacity to respond to these challenges will depend on the nature and level of resources, both human and material, which are made available to schools (2015).

In conclusion, the short course was welcomed by both students and teachers within each of the case schools. Simultaneously, it was treated differently in terms of its initial implementation, and the schools have developed policies and practices that are very similar.

7. 3 Suggestions for Further Research

Further research, within this area, could explore the impacts of teacher confidence or teacher practice. A detailed description of the reforms and the contextual information was provided; details relating to the two schools have been limited to maintain the two schools' anonymity, the four teachers, and the students involved. Moreover, only two lower-second-level schools participated in the study. As a small sample, it provides us with an in-depth exploration of the complexities of introducing and enacting policy. However, it is not possible to make generalizations' across education settings. In the future, it may serve to study the enactment of Coding/ CSE in a larger number in order to see if the impacts witnessed within these educational settings are also found in other schools. I would like to propose the following topics as areas for further research:

- An exploratory case study of a single case school, where interviews are carried out with a wider variety of stakeholders, including school management and administrative staff.
- A longitudinal study of student approaches and attitudes to CSE across educational settings. Tracking a small group of students as they move through primary to secondary and onto the third level.

- In 2020, students will be entering college for the first time, with potentially having studied CSE at both upper and lower secondary levels. An exploration of the progress students make, and the courses they choose to study would be interesting.

Additionally, it is hoped that the research presented within this dissertation may be utilised to compare a future research study to understand how developments may alter with time.

7. 4 Concluding Comments

In conclusion, this research study is the accumulation of two years of research, observation, and data analysis from two lower-second-level schools, who have been involved in the adoption of the short course in Coding. This case study framework was designed to provide a microanalysis of the impacts previously examined at a national level. The schools involved provided a rich insight into the enactment of CSE policies in lower-second-level. This research project presented a clear exploration of the emerging landscape of CSE within each of our case schools. It outlines some of the visible and invisible impacts, which both schools experienced following Coding's introduction to their students.

This study aimed not to generalise across educational settings but rather to explore local action within two distinct case studies. Despite this, specific patterns have emerged within the data, and it can be concluded that the schools had more in common than separating them. As revealed by each of the case schools, Coding's introduction was ‘complexly configured, contextually mediated and institutionally rendered’ (Bell et al., 2014, p. 3). Four main results were produced from this research study:

- The first finding indicates that school culture plays a critical role in adopting policy change.
- The second finding was that teachers identified that supports both internal and external agencies was beneficial.
- The third that 95% of students enjoyed one or more aspects of the short course in Coding.
- The fourth finding was that prior experiences are a crucial factor when it comes to student’s confidence.

This case study has taken place over a two-year period, and every effort was made to ensure the validity of results. Following the research data exploration, it was found that support and collaboration between all local

actors were pivotal to the success and expansion of policy enactment in each of our case schools. The impacts of this research have the potential to impact future policy and decision making across educational settings. Indeed, from September of 2020, students, for the first time, will be entering the third level having studied CSE over the five years of second-level education, and potentially having obtained certification at both lower and upper-second-level. However, how many of them will choose to onto further study in this area? Will they be more confident than their classmates will? Are the efforts being made going to lead to a more significant division, between those with who study CSE at the primary and second level and those without the option to do so?

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Appendices

Contents

Appendix I. Letter to The Principal of Schools

EHSREC No: 2019_05_14_ EHS

Date: _____

Dear Principal **[insert name**],

Junior Cycle Coding in Action (JCCiA) was an initiative designed to support teachers and schools as they introduce the Coding short course to their students. The JCCiA initiative is run by the Junior Cycle for Teachers (JCT), and the official research partner for the initiative was the University of Limerick. Your school was part of the first cohort of prestigious schools to take part in JCCiA. Now that the initiative has come to an end, we are hoping to gather data on the experiences of the teachers and students who have been impacted by the initiative.

We are writing as we would like to have the voices of one member of staff and one group of students from your school [insert name] included in this research. This would involve visiting the school to gather feedback from approx. Twenty-five students and conduct an interview with one teacher. Students will be asked to complete the short (10 questions) feedback sheet on their experiences of the Coding short course. The feedback will be gathered, with your consent as principal of the school, the students and their parents, and the teachers who will be interviewed.

The time and location of the research being conducted will be at the desecration of the school and teachers involved. The research will be conducted with minimal impact on your school, pupils, and staff. The information will be stored on the researcher's computer, which will be password-protected. The data collected will be used to formulate publications and academic papers by the research team. The data will be kept for seven years, after which time it will be deleted and/or disposed of sensitively. Only four schools in Ireland have been selected to take part in this study.

Participation in this study is entirely voluntary, and any of the participants may choose not to consent or to withdraw consent at any time. Students who do not wish to take part may carry on with their normal activities. If you have any concerns or questions about the study, please contact one of the other investigators or me. Should you wish to take part in the valuable and unique study, please email una.fleming@ul.ie at your nearest convenience, so that additional information, as well as the consent form, may be sent to you. Once your consent to take part in the study has been established, date and time for the researchers to visit your school will be arranged.

Thank you for taking the time to read this letter. As the research team, we would be extremely grateful if you would consider participating in this study.

Principal Investigator Contact Details:
Professor Merrilyn Goos, Director of EPI*STEM – National Centre for STEM Education, School of Education, University of Limerick. Tel: (061) 202063. Email: MerrilynGoos@ul.ie

Other investigator
Úna Fleming
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Clare McInerney
Education & Outreach Manager
Lero – the Science Foundation Ireland Research Centre for Software
University of Limerick
Ireland
Tel: 061 202434
Email: Clare.McInerney@lero.ie

This research study has received Ethics approval from the Education and Health Sciences Research Ethics Committee (quote approval number).
If you have any concerns about this study and wish to contact someone independent, you may contact:
Chairman of Education and Health Sciences Research Ethics Committee
EHS Faculty Office
University of Limerick
Tel (061) 234101

Appendix II. Principal Information Sheet

EHSREC No: 2019_05_14_ EHS

Dear Principal of [insert school name here],

We are involved in a study to gather teachers and student experiences of the short course in Coding. This information sheet will tell you what the study is about.

What is the study about?

The study is designed to gather student and teacher feedback on their experiences of the short course. Students and teachers will have an opportunity to have their opinions appear in research publications.

What will your school have to do?

Your school's involvement in the study is voluntary and take place on school grounds, during the school day. They will be asked to give feedback on the short course in Coding; the feedback sessions will take no more than 30 minutes each.

What are the benefits?

Your school can contribute to research and have their opinions and experiences of both student and staff formally documented.

What are the risks?

Some of the participants might decide that they do not want to answer a question or participate in the study. If this happens, they do not have to participate or answer any question they do not wish to. The times and location of the research being conducted will be at the desecration of the school and teachers involved. The research will be conducted with minimal impact on your school, pupils, and staff. The researcher will be in your school for no longer than one hour.

What if my school does not want to take part?

Participation in this study is voluntary. If you choose not to take part or to stop involvement in this study, please notify the research team as soon as possible.

What happens to the information?

The information that is collected will be kept in private and stored securely on the researchers' computer. The computer will be password-protected. The schools, pupils and teachers names will not be used as an identifier within any report or research publication. The information that is gathered in the study will be kept for seven years. After this time, it will be destroyed.

Who else is taking part?

Your school is one of four schools that have been invited to take part in the study.

What if something goes wrong?

In the unlikely event that something goes wrong while the researchers are in your school, the session will immediately stop, and school staff will be informed immediately.

What happens at the end of the study?

At the end of the study, the information will be used to present results and to produce research papers/ reports. No names will appear in any of the outputs of the study. All data gathered from the research will be stored securely for seven years. Information that is stored on a password-protected computer.

What happens if my school changes our mind about our participation in the study?

There are no consequences for your school if you change your mind about being in the study. If this accrues, please notify the research team as soon as possible.

What if you have questions?

If you have any questions about the study, you may contact any of the researchers involved in this project. The researchers and their contact details are listed below.

Contact name and number of Project Investigators.

Principal Investigator Contact Details:

Professor Merrilyn Goos, Director of EPI*STEM – National Centre for STEM Education, School of Education, University of Limerick. Tel: (061) 202063. Email: MerrilynGoos@ul.ie

Other investigator
Úna Fleming
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Other investigator
Clare McInerney
Education & Outreach Manager
Lero – the Science Foundation Ireland Research Centre for Software
University of Limerick
Ireland
Tel: 061 202434
Email: Clare.McInerney@lero.ie

Thank you for taking the time to read this. I would be grateful if you would consider giving consent for your school to participate in this study.

This research study has received Ethics approval from the Education and Health Sciences Research Ethics Committee (quote approval number). If you have any concerns about this study and wish to contact someone independent you may contact: Chairman of Education and Health Sciences Research Ethics Committee EHS Faculty Office University of Limerick Tel (061) 234101

Appendix III. Principal Consent Form

EHSREC No: 2019_05_14_ EHS

SCHOOL CONSENT FORM

❑I have read and understood the information sheet that has been provided to me.

❑I understand what the study is about and what students' feedback will be used for.

❑I understand that the research will take no longer than 30 minutes of students' time.

❑I understand that students names will not appear on any research papers or reports produced as a result of this study.

❑I give permission for students' feedback and data to be used in future publications.

❑I am fully aware of all of the procedures involving my students and of any risks and benefits associated with the study.

❑I know that students' participation is voluntary and that I can withdraw my school's participation in the study at any stage without giving any reason.

After considering the above statements, I consent to my School's _____(name) involvement in this research project.

Name of School: (please print): _____

Principal Signature : _____ Date: _____

Investigator's Signature _____ Date: _____

EPI·STEM National Centre for STEM Education

Lero THE IRISH SOFTWARE RESEARCH CENTRE

SCHOOL OF EDUCATION UNIVERSITY OF LIMERICK

Appendix IV. Parent/Guardian Information Sheet

EHSREC No: 2019_05_14_ EHS

Dear Parent/Guardian,

We are involved in a study to gather teachers and student experiences of the **Junior Cycle short course in Coding**. This information sheet will tell you what the study is about.

What is the study about?
The study is designed to gather student and teacher feedback on their experiences of the short course in Coding. Students and teachers will have an opportunity to talk to the researchers and to have their opinions appear in research publications.

What will your child have to do?
Your child will be asked to give feedback on the short course in Coding. Your child's involvement in the study is voluntary. The research will be conducted with minimal impact on your child's learning and will take no more than 30 minutes.

What are the benefits?
Your child can contribute to research and have their opinions and experiences formally documented.

What are the risks?
Your child might decide that he/she doesn't want to answer a question. If this happens, they do not have to answer any question they do not wish to.

What if my child does not want to take part?
Participation in this study is voluntary, and your child can choose not to take part or to stop involvement in this study at any time.

What happens to the information?
The information that is collected will be kept in private and stored securely on the researchers' computer. The computer will be password-protected. Your child's name will not be used as an identifier within any report or research publication. The information that is gathered in the study will be kept for seven years. After this time, it will be destroyed.

Who else is taking part?
Other students from your child's school and students from three other schools are invited to take part in the study. Your child's *Coding* teacher may also wish to be involved in the research.

What if something goes wrong?
In the unlikely event that something goes wrong while your child is with the researchers, the session will immediately stop, and school staff will be informed. If the student would like to restart the session or to stop, they may choose to do so.

What happens at the end of the study?

The feedback which has been gathered from students will be used to produce research papers/ reports. No child's name will appear in any of the outputs of the study. All data gathered from the research will be stored securely for seven years. Information that is stored on a password-protected computer.

What happens if my child changes their mind during the study?
At any stage should your child feel that they want to stop taking part in the study, they are free to stop and take no further part. There are no consequences for your child if they change their mind about being in the study.

What if my child or I have questions?
If you or your child have any questions about the study, you may contact any of the researchers.

Contact name and number of Project Investigators.

Principal Investigator Contact Details:
Professor Merrilyn Goos, Director of EPI*STEM – National Centre for STEM Education, School of Education, University of Limerick. Tel: (061) 202063. Email: MerrilynGoos@ul.ie

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Lero – the Science Foundation Ireland Research Centre for Software
University of Limerick
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Tel: 061 202434
Email: Clare.McInerney@lero.ie

Thank you for taking the time to read this. I would be grateful if you would consider giving consent for your child to participate in this study.

This research study has received Ethics approval from the Education and Health Sciences Research Ethics Committee (quote approval number). If you have any concerns about this study and wish to contact someone independent, you may contact:
Chairman of Education and Health Sciences Research Ethics Committee
EHS Faculty Office University of Limerick Tel (061) 234101

Appendix V. Parent/Guardian Consent

EHSREC No: 2019_05_14_ EHS

Feedback on the Junior Cycle Short course Coding

- ❑I have read and understood the Parent/Guardian information sheet.
- ❑I understand what the study is about and what my child's feedback will be used for.
- ❑I understand where the research will be carried out.
- ❑I understand that my child's name will not appear on any outputs of the study.
- ❑I give permission that my child's feedback can be used and published in research papers and reports.
- ❑I am fully aware of all of the procedures involving my child and of any risks and benefits associated with the study.
- ❑I know that my child's participation is voluntary and that I can withdraw my child's participation in the study at any stage without giving any reason.

After considering the above statements, I consent to my child _____(name) involvement in this research project.

Name of Child: (please print): _____

Name of Parent/Guardian: (please print): _____

Parent Signature : _____ Date: _____

Appendix VI. Student Information Sheet

EHSREC No: 2019_05_14_ EHS

Dear Student,

We are involved in a study to gather student experiences of the **Junior Cycle short course in Coding**. This information sheet will tell you what the study is about.

What is the study about?
The study is designed to gather student and teacher feedback on their experiences of the short course. Students and teachers will have an opportunity to talk to the researchers and to have their opinions appear in research publications.

What will I have to do?
Your involvement in the study is voluntary. You will be asked to give feedback on the short course in Coding. The feedback session will take no more than 30 minutes.

What are the benefits?
You can contribute to research and have your opinions and experiences formally documented.

What are the risks?
You might decide that you don't want to answer a question. If this happens, you do not have to answer any question you do not wish to.

What if I do not want to take part?
Participation in this study is voluntary, and you can choose not to take part or to stop your involvement in this study at any time.

What happens to the information?
The information that is collected will be stored securely and safely on the researchers' computer. The computer will be protected with a password. Your name will not appear on any information. The information that is gathered in the study will be kept for seven years; after this time, it will be destroyed.

Who else is taking part?
Other students from your school and students from three other schools are invited to take part in the study. Your teacher may also wish to be involved in the research.

What if something goes wrong?
In the unlikely event that something goes wrong while you are giving your feedback, the session will immediately stop until the researcher and student(s) are ready to restart the session, or the session would be stopped completely.

What happens at the end of the study?

At the end of the study, the information will be used to present results and to produce research papers/ reports. Your name will not appear in any of the outputs of the study. All data gathered from the research will be stored securely for seven years. Information that is stored on a password-protected computer.

What if I have more questions or do not understand something?

If you have any questions about the study, you may contact either of the researchers. It is important that you feel that all your questions have been answered.

What happens if I change my mind during the study?

At any stage should you feel that you want to stop taking part in the study, you are free to stop and take no further part. There are no consequences for changing your mind about being in the study.

Contact name and number of Project Investigators.

Principal Investigator Contact Details:

Professor Merrilyn Goos, Director of EPI*STEM – National Centre for STEM Education, School of Education, University of Limerick. Tel: (061) 202063. Email: MerrilynGoos@ul.ie

Other investigator	**Other investigator**	**Other investigator**
Úna Fleming	Dr Oliver McGarr	Clare McInerney
Education Researcher	School of Education	Education & Outreach Manager
EPI*STEM Centre	Faculty of Education and Health Sciences	Lero – The Irish Software Research Centre
University of Limerick	University of Limerick	University of Limerick
Limerick	Ireland	Ireland
Ireland	Tel: 061 202934	Tel: 061 202434
Tel: 061 204645	Email: oliver.mcgarr@ul.ie	Email: Clare.McInerney@lero.ie
Email: Una.Fleming@ul.ie		

Thank you for taking the time to read this. I would be grateful if you would consider participating in this study.

This research study has received Ethics approval from the Education and Health Sciences Research Ethics Committee (quote approval number).
If you have any concerns about this study and wish to contact someone independent, you may contact:
Chairman of Education and Health Sciences Research Ethics Committee
EHS Faculty Office
University of Limerick
Tel (061) 234101

Appendix VII. Participant Consent – Students

EHSREC No: 2019_05_14_ EHS

FEEDBACK ON THE JUNIOR CYCLE SHORT COURSE CODING

Should you agree to participate in this study, please read the statements below, and if you agree to them, please sign the consent form?

- ❑I have read and understood the information sheet.
- ❑I understand what the project is about and what the results will be used for.
- ❑I understand that my name will not be given to anyone in any written material developed.
- ❑I am fully aware of what I will have to do and of any risks and benefits of the study.
- ❑I know that I am choosing to take part in the research and that I can stop taking part in the study at any stage without giving any reason to the researchers.

After considering the above statements, I consent to my involvement in this research project.

Name: (please print): _____

Signature: _____ Date: _____

Appendix VIII. Student Survey: Junior Cycle Coding short course Coding

EHSREC No: 2019_05_14_ EHS

Please select an answer by circling it. Alternatively, and where appropriate, please write your response using as much detail as you can.

What year are you in: **1st year / 2nd year / 3rd year / Transition Year**

Are you: **Male / Female**

Do you agree to answer all questions truthfully and to the best of your ability?

Yes / No

1. If you did coding before, where did you do it (Primary school/ club/ home)? _____
2. Is the short course in Coding optional (you decided to study it) or compulsory (everyone has to study it) in your school? **Optional/ Compulsory**
3. Do you feel the short course in Coding should be optional or compulsory for Junior Cycle students in Ireland? **Optional/ Compulsory**
4. Please explain why? _____

_____

_____

5. Please list what you like and dislike about the short course in Coding?

I like the short course in Coding because….	I dislike the short course in Coding because….

6. What advice would you give to a teacher teaching the short course in Coding?

_____

_____

_____

7. What advice would you give to another student who is about to start the short course in Coding?

_____

_____

_____

8. Has taking the short course in Coding impacted the way that you approach other subjects? If so, how?

_____

_____

_____

9. Would you be interesting in learning more about any of the topics which you explored as part of the short course in Coding? **Yes / No**

10. Please explain your answers?

_____

_____

_____

Do you have any additional comments or feedback?

_____

_____

_____

_____

Appendix IX. Teacher Information Sheet-Interview

EHSREC No: 2019_05_14_ EHS

Dear Teacher,

We are involved in a study to gather teachers and student experiences of **the Junior Cycle short course in Coding**. This information sheet will tell you what the study is about.

What is the study about?
It is the aim of this study to document practitioner perspectives of introducing the new course in Coding and to critically examine the JCCiA initiative through the lens of knowledge exchange and teaching. It will do this by exploring how teachers developed as professional practitioners by engaging with CPD initiative. As part of this, we are seeking your participation in an interview and student feedback.

What will I have to do?
Your involvement in the study is voluntary. You are invited to take part in an interview session, which will last no longer than 30 minutes.

What are the benefits?
You can contribute to research and have your opinions and experiences of teaching the short course in *Coding* formally documented.

What are the risks?
You might decide that you don't want to answer a question, if this happens, you do not have to answer.

What if I do not want to take part?
Participation in this study is voluntary, and you may choose not to take part or to stop your involvement in this study at any time.

What happens to the information?
The information that is collected will be kept private and stored securely and safely on the researchers' computer. The computer will be password-protected. Your name will not appear on any information. You will be assigned a fictitious name when the data is being written in a report by the researcher. The information that is gathered in the study will be kept for seven years. After this time, it will be destroyed.

Who else is taking part?
Four JCCiA teachers, from phase one, will be interviewed. Student feedback will also be gathered from two schools.

What if something goes wrong?

In the unlikely event that something goes wrong during the interview, the session will immediately stop until you are ready to restart the session, or the session would be stopped completely.

What happens at the end of the study?
At the end of the study, the information will be used to present results. No names will appear in any of the publication. All data gathered from the research will be stored securely by the researcher team for seven years on a password-protected computer.

What if I have more questions or do not understand something?
If you have any questions about the study, you may contact any of the researchers.

What happens if I change my mind during the study?
At any stage should you feel that you want to stop taking part in the study, you are free to stop and take no further part. There are no consequences for changing your mind about being in the study.

Contact name and number of Project Investigators.

Principal Investigator Contact Details:
Professor Merrilyn Goos, Director of EPI*STEM – National Centre for STEM Education, School of Education, University of Limerick. Tel: (061) 202063. Email: MerrilynGoos@ul.ie

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Other investigator
Clare McInerney
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Lero – The Irish Software Research Centre
University of Limerick
Ireland
Tel: 061 202434
Email: Clare.McInerney@lero.ie

Thank you for taking the time to read this. I would be grateful if you would consider participating in this study.

This research study has received Ethics approval from the Education and Health Sciences Research Ethics Committee (quote approval number).
If you have any concerns about this study and wish to contact someone independent, you may contact:
Chairman of Education and Health Sciences Research Ethics Committee
EHS Faculty Office
University of Limerick
Tel (061) 234101

Appendix X. Teacher Interview Consent

EHSREC No: 2019_05_14_ EHS

Junior Cycle Coding short course Coding

Should you agree to participate in this study, please read the statements below, and if you agree to them, please sign the consent form?

- ❑I have read and understood the information sheet.
- ❑I understand what the project is about and what the results will be used for.
- ❑I understand that what the researchers find out in this study may be shared with others, but that the data collected will be stored securely and I will not be named in any materials produced.
- ❑I am fully aware of what I will have to do and of any risks and benefits of the study.
- ❑I know that I am choosing to take part in the research and that I can stop taking part in the study at any stage without giving any reason to the researchers.
- ❑I agree with the statements above, and I consent to take part in this interview.

This study involves the recording of the interview sessions. Please circle either Agree/Disagree below.

I am aware that the interview will be recorded and I agree with this. However, should I feel uncomfortable at any time I can ask that the recording equipment be switched off? I know that I can ask for a summary of the interview session. I understand what will happen to the recordings once the study is finished.

Agree / Disagree

This study involves the use of interview data for the creation of reports and publications. Please circle either Agree/Disagree below.

I am aware that the interview content will be used for the creation of reports and publications, and I agree with this. However, should I feel uncomfortable at any time I can ask that the recording equipment be switched off? I know that I can ask for a summary of the interview session. I understand what will happen to the recordings once the study is finished.

Agree / Disagree

After considering the above statements, I consent to my _____(name) involvement in this research project.

Name of Teacher: (please print): _____

Investigator's Signature _____ Date: _____

EPI-STEM National Centre for STEM Education

Lero THE IRISH SOFTWARE RESEARCH CENTRE

SCHOOL OF EDUCATION UNIVERSITY OF LIMERICK

Appendix XI. Teacher Interview

EHSREC No: 2019_05_14_ EHS

Junior Cycle Coding short course Coding

Following a review of relevant literature and close examination of the ethics guidelines, the researchers have formulated the questions that they would like to include the interview.

Interviewee (Title and Name): _____

Interviewer: _____ Time and date: _____

Interviewee has had time to review the information sheet and has consented to the interview: **Yes/No**

A: Interviewee Background:

1. Where did you train? _____
2. What are your primary subjects which you teach? _____
3. When did they start teaching coding? _____
4. Why coding (question asked to understand motivation)? _____

_____

B: Department and School:

1. When did you start teaching in the school? _____
2. Do you feel supported in this school? (Why?) _____

C: Perspective on CPD:

1. Define CPD? _____
2. How do they feel about CPD in general? _____
3. What do they find challenging/successful? _____
4. What is different about JCCiA CPD initiative? _____
5. What are the barriers to CPD? _____

D: Teaching and Learning:

1. How do you feel you learn best? _____
2. What are the benefits of the JCCiA CPD? _____
3. What impact has JCCiA had on your teaching? _____
4. What specific new teaching or assessment practices have you implemented in your classes?

_____

5. Has it impacted the way that you teach/ approach other subjects? _____

6. What is being accomplished through the JCCiA initiatives? _____

7. How do you know this? _____

8. What, if any, changes to the programme would have made the experience more enjoyable/beneficial?

_____

Post Interview Comments or Leads:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix XII. School Inspection Reports

Contents

1. Subject inspection of Spanish 2007

The following are the main strengths identified in the evaluation:

- Provision for languages at the school is excellent.
- Curriculum provision within the school, coupled with appropriate timetabling, facilitates the growing uptake of Spanish.
- Management is aware that the growing numbers for Spanish will necessitate the appointment of another fully qualified teacher of Spanish.
- Teachers are commended for their organisation of co-curricular activities for the language.
- The long-term plan for Spanish shows evidence of much good work. Suggestions for its further development, particularly for the growing senior cycle, are contained in the body of this report.
- The plan for transition year is appropriate and in line with the overall aims of ty.
- Individual planning for lessons is good, emphasises the integration of the different language skills, and includes some strategies for active-learning.
- In lessons observed, visual aids, including PowerPoint presentations, were used effectively.
- Appropriate emphasis was placed on correct pronunciation and language awareness.
- In all lessons, good classroom management and positive teacher-student rapport contributed to the pleasant classroom atmosphere.
- Students showed a good understanding of lesson content and responded well to questioning.
- Appropriate formal and informal assessment is carried out regularly. Commendably, assessment procedures include both oral and aural assessment for all year groups.

As a means of building on these strengths and to address areas for development, the following key recommendations are made:

- It is recommended that efforts be made in all lessons to maximize the use of the target language for meaningful communication in the classroom.
- The active participation of students through active-learning strategies should be expanded and developed.
- It is suggested that more regular monitoring of copybooks in some classes would be of benefit to students.
- Teachers should renew membership of the association of teachers of Spanish to keep up-to-date with recent developments in the teaching of Spanish nationally.
- It is to be hoped that, in the long term, language classrooms will be teacher-based.

2. Subject inspection of Italian 2009

A particular feature of [redacted] is its strong emphasis on information and communication technology (ict) for teaching and learning. One of the school's stated aims is "the seamless integration of ict throughout the curriculum". The school management and the teachers are to be congratulated on the progress already made towards achieving this aim. Every student has a laptop computer. The school is a Wi-Fi campus, and every classroom is equipped with a data projector. The school has its collaboration portal based on google infrastructure and teachers are encouraged to make full use of this technology.

The following are the main strengths identified in the evaluation:

- [redacted] has a strong commitment to teaching modern European languages.
- Arrangements for student choice and access to Italian are very good.
- The uptake of Italian in [redacted] is very healthy.
- There is a school plan for Italian and the lessons observed were well planned.
- The Italian teachers demonstrate a good mastery of the language and model excellent spoken Italian to their students.
- The standard of teaching in the lessons observed was generally good.
- A variety of teaching methods and resources, including the use of ict, was used in the lessons observed.

As a means of building on these strengths and to address areas for development, the following key recommendations are made:

- The subject plan for Italian should be developed to specify learning outcomes in different language skills, teaching methodologies to be used, and the role of the language assistant.
- The production of authentic spoken and written Italian by the students should be made a priority.
- A definite strategy should be devised to ensure that Italian becomes the language of instruction and communication in all classes and to reduce the current reliance on a translation.
- Consideration should be given as to how the school's excellent ict facilities could be used more extensively and effectively for the teaching and learning of Italian.

3. Subject inspection of chemistry 2010

A particular feature of this school is the emphasis it places on the use of information and communication technology (ict). There is an outstanding provision of ict resources in the school. Each room that was visited was equipped with a data projector, and each teacher had the use of a laptop computer. Where experimental work was observed, the necessary resources were available, and they were sufficient for the work to be completed.

There is good support from the school for the science teachers' continuing professional development. The teachers are members of their subject association, and they engage in ongoing professional development by, for example, attending courses and undertaking further study. In addition, the science teachers support the students' participation in a wide range of science-related extracurricular activities such as scifest, science week, faulkes telescopes universe challenge, educational talks, and visits to third-level institutions.

Students were enthusiastic about their learning. They were engaged, and they showed themselves to be interested in the lesson topics.

The following are the main strengths identified in the evaluation:

- The science and chemistry staff is professional, dedicated and committed in its work.
- The quality of subject planning was excellent.
- There was a positive atmosphere in every lesson observed.
- Classroom management was good for all lessons inspected.
- Appropriate assessment practices were in place.

As a means of building on these strengths and to address areas for development, the following key recommendations are made:

- The science teachers should use an analysis of the students' results in the certificate examinations to priorities the areas in which they can further improve students' attainment. They should monitor and assess the improvements resulting from their actions.

The science teachers should expand the range of methodologies they use to avoid an over-reliance on note taking and questioning.

4. Subject inspection of Irish 2010

School management is aware of the significant role information and communications technology (ict) has in present-day life and especially in the life of teenagers. Therefore, it is school policy to make every effort to link ict to as many aspects of school life as possible. It is very worthwhile for the school to have such a policy as the closer the learning experiences are to the everyday life of the students; the easier it is to motivate them to participate.

The following are the main strengths identified in the evaluation:

- The school makes use of as many opportunities as possible to link ict with activities in Irish classes.
- Teachers of Irish are diligent workers and are very committed to promoting Irish among young people.
- Every effort is made to promote the use of Irish outside the classroom.
- Teachers are fully involved in the subject development planning process.
- Within the Irish department, teachers discuss their classroom practice.
- Teachers made extensive preparation for the lessons observed.
- Overall, Irish was the principal language of communication in the lessons observed.
- Students were set to communicate with each other.
- A positive, cooperative atmosphere was evident in the classes.
- Students were set a range of different activities.
- Effective use was made of resources.
- The assessment system provides a balance between the four language skills.
- All participants are informed of student progress on a regular basis.

As a means of building on these strengths and to address areas for development, the following key recommendations are made:

- It is recommended that, as part of the subject development planning process, teachers would focus on the correct use of Irish during lessons.
- It is recommended that the principal language structures to be acquired by students during the lesson be identified in advance.
- It is recommended that even further use be made of strategies, which promote communication among students.

5. Subject inspection of home economics 2012

Main findings

- The quality of teaching and learning in home economics, as observed, was very good.
- Knowledgeable, highly skilled teachers delivered content-rich lessons.
- The members of the subject department are well advanced in terms of the integration of information and communication technology (ict) into their teaching.
- Students' active participation in lessons was promoted.
- An appropriate allocation of time and access to a very good quality room support teaching and learning in the subject.
- Teachers' commitment to planning is evident in the department's comprehensive subject plan and very well developed programmes of work.

Main recommendations

- Teachers should explore opportunities for the inclusion of co-operative learning strategies.
- It is recommended that the overall approach to the organisation, filing and monitoring of students' work be formalised.
- With a view to increasing uptake of home economics at senior cycle, the board is advised to keep the school's approach to subject choice under review.
- The requirement of students to choose, upon entry to ty, the subjects they will eventually, study to leaving certificate level should be reconsidered.

6. Subject inspection of music 2012

Main findings

- A good quality of teaching and learning was observed in the lessons visited.
- The department has an extensive range of resources, including information and communication technology (ict) which is used to good effect.
- Music has a high profile, is supported by management and is available to all students.
- There is a wide range of extra-curricular music activities in which all students can participate.
- Very good progress has been made with subject department planning which includes the use of ict resources and planning for eLearning.
- Some consideration has been given to addressing the gender imbalance in the uptake of music.

Main recommendations

- Teachers should ensure that teacher-led instruction is well balanced with student input in all lessons.
- Opportunities, where students are engaged in collaborative and self-directed learning, should be further expanded.
- Consideration should be given to the manner in which the three areas of performing, composing and listening could be integrated in musically focused ways in all lessons.

7. Subject inspection of guidance 2013

Strong links to the external community, business and educational interests have been established. These links facilitate a variety of experiences for students in the school through visits by, for example, local businesses under the business in the community scheme and by representatives of institutions of further and higher education. Similarly, these links are used to facilitate visits by students to those organisations. It is of note that, in the development of these links, student attendance and retention are among the objectives of the guidance department. This is good practice.

Main findings

- The quality of teaching observed was very good.
- The leadership of the guidance department is evident in its involvement in a wide range of activities in support of students.
- The collaborative links that have been established by the school enable the provision of a variety of learning experiences for students both in the school and with external agencies.
- A reduction in the hours for the provision of guidance has necessitated the increased involvement of all staff in the provision of supports for students.
- The documentation prepared, and in use by, the guidance department is of a very high standard.

Main recommendations

- It is recommended that the guidance and support roles and responsibilities of all staff be reviewed and clarified.

8. Subject inspection of biology 2014

Main findings

- The quality of teaching and learning was good in the lessons observed.
- There was a positive learning environment with good affirmation of student effort.
- There is a strong emphasis on the use of information and communication technology (ict) in
- The school, and where it was used, it was integrated well into lesson delivery.
- Teachers share the teaching of some classes at junior cycle.
- There was clear evidence of planning and preparation for the lessons observed.

Main recommendations

- The science team should audit existing available resources within the science facilities, with
- The purpose of improving them over time.
- The safe storage of chemicals should be enhanced through colour coding all chemicals for ease
- Of safe storage.
- More detailed plans need to be developed for transition year.
- The subject plan should include a section on the area of practical work.

9. Subject inspection of French 2015

Main findings

- Good quality teaching and learning was evident in all the lessons observed.
- Lessons were well structured, and the varied activities allowed students many opportunities for participation and engagement.
- There is a clear commitment to supporting students' learning through assistance to individual students.
- Provision for foreign languages is very strong and French benefits from appropriate timetabling allocation and resources, and from support for teacher professional development.
- The increase in the uptake of French is very positive.
- The range of co-curricular activities and the emphasis on cultural awareness is commendable.

Main recommendations

- In order to increase students' confidence in speaking French, there should be an emphasis on pronunciation strategies as well as increased opportunities for communication in the language.
- Time for students to assess their learning at the end of the lesson should be factored into lesson planning.

10. Technical graphics and design & communication graphics 2019

Findings

- High-quality student learning was facilitated through good quality, and in some cases,
- Exemplary teaching.
- Generally, teachers modelled procedural skills effectively; however, on occasion,
- Opportunities were missed to introduce new learning through teacher demonstration and
- The effective modelling of good practice.
- Structured and informal student collaboration were positive characteristics of all lessons
- Observed.
- Graphics subjects receive very good support from school management.
- Overall, the quality of subject planning and individual teacher preparation was very good
- With some scope for improvement identified in the current transition year (ty) plan.
- Planned DEIS actions aimed at improving students' learning and literacy levels were
- Observed in all lessons.

Recommendations

- Teachers should ensure that all new concepts, principles and procedures are deliberately taught in a structured manner that is underpinned by teacher demonstration or structured facilitation.
- The ty plan should be reviewed to ensure that students who choose dcg experience an interesting and significantly different approach to the teaching and learning of the subject.

11. School response to 2019 inspection

- School management supports and facilitates teachers' engagement in continuing professional development. Subject teachers have recently attended cpd courses that focus on areas including parametric modelling, new junior cycle specifications and other science, technology, engineering and mathematics (stem) disciplines such as coding.
- The school's engagement with, and its development of, a junior cycle stem short course may help to develop a symbiotic relationship between graphics subjects and the stem curriculum in general. Key transferrable skills such as being creative, communicating and managing information and thinking, should be fostered through the graphics subject's planning processes, particularly in the context of the new graphics specification at junior cycle.
- Students are given very good opportunities to make well informed optional subject choices. This is achieved through the provision of a sampling period in first year, a modular transition year (ty)

programme and information provided for parents at key decision-making times in their child's progression through the school.

The board is very pleased with the findings of the report, particularly: the "high-quality student learning". The positive characteristics of "structured and informal student collaboration" observed - the 'very good" quality of subject planning and teacher preparation - the observed actions aimed at improving students' learning and literacy levels. The recommendations, as outlined in the report, are welcomed. These recommendations will be used to inform, guide and develop current and future practice in these subject areas.

12. Whole-school evaluation management, leadership and learning 2016

School-based initiatives and projects were evident within classroom practice. The capacity for innovation and enterprise within the teaching staff is strong and is reflected in the breadth of the school's curricular and extra-curricular provision.

While members of the school community display a genuine wish to provide a broad educational experience that meets the highly diverse needs of its student cohort, review of school policies and other documentation suggests the lack of a clear, cohesive vision that informs their work. A collective exploration of its vision would be of benefit as it would allow for the identification of a guiding mission that would inform work at all levels of the school's operation. This, in turn, would support DEIS action planning whereby the goals of school-based working groups, who lead action in priority areas, are derived from the school's own guiding mission.

13. Follow-through inspection 2017

Commendably, staff members at all levels are leading a wide range of change initiatives. Revisions made to the roles and responsibilities attached to assistant principal positions have allowed for highly effective collaboration within working groups as the school reengages with DEIS planning and policy review. Moreover, the significant investment, of both time and effort, made by all in identifying a renewed guiding mission, ensures that a palpable sense of purpose and a continual focus on student learning underpins all of this work. It was clear during this follow-through inspection that the quest to ensure optimum levels of student learning and wellbeing permeated all areas of the school's work. Teachers' ownership and commitment to school-improvement initiatives were particularly noteworthy.

14. UCS inspection report

Findings

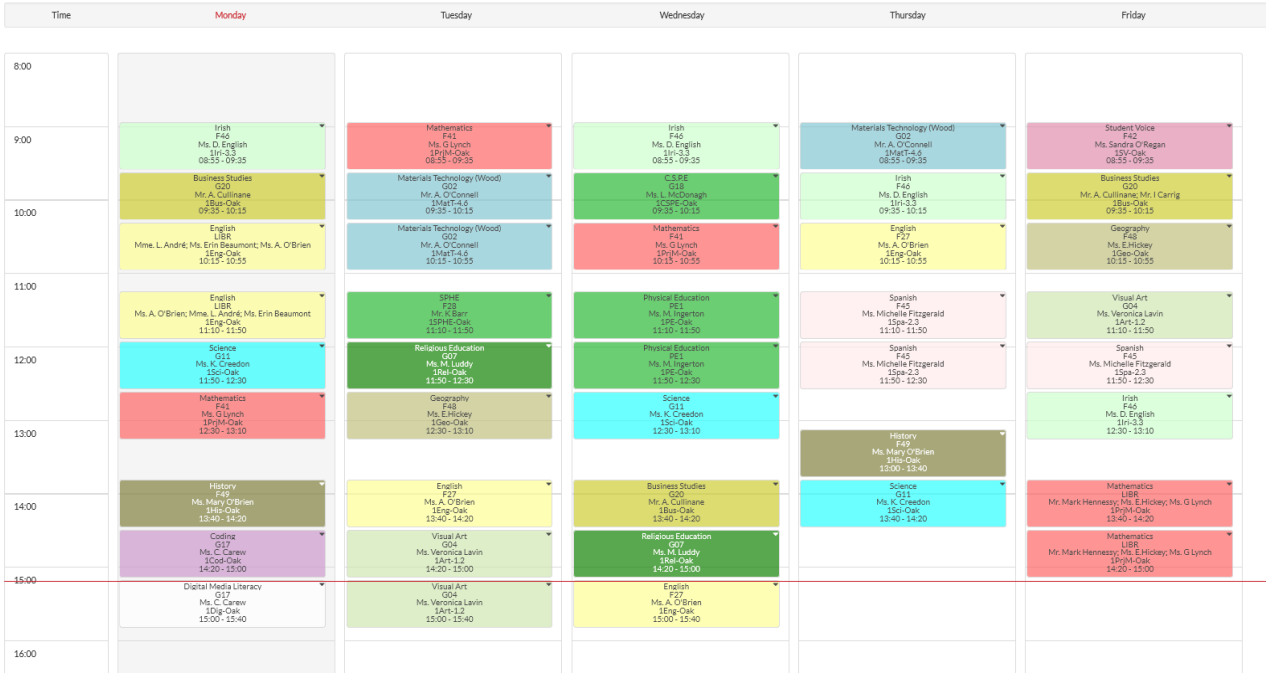
- Students are respectful, affirmed by teachers, and are very strongly supported by the school's JCSP library service, by JCSP initiatives, and by school management,
- The overall quality of teaching observed was good, with some exemplary practices noted; further development of a process approach to writing and of strategies for guiding students to manage their materials is needed.
- The overall quality of learning observed was good, supported by some very good assessment practices; there is scope to develop more supports for the more able and for frequent non-attenders.
- In the area of collective planning and preparation, strengths were noted in the establishment of supportive working relationships among the recently-amalgamated staff, the sharing of resources, the compilation of plans for different year groups, and the establishment of some meetings of teachers working with the same year groups; action is required to improve the formal functioning of the subject department.
- The quality of subject provision and of whole-school support is very good, with scope for development in relation to the literacy classes provided to first and second-year students.

Recommendations

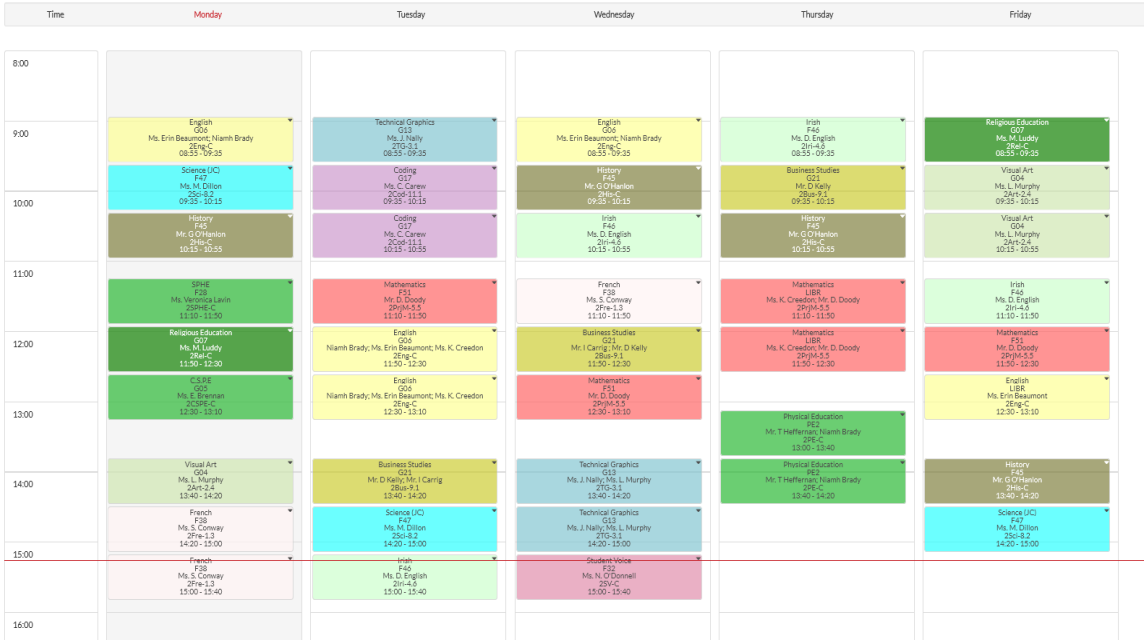
- The subject department needs to develop common approaches to the teaching of a process approach to writing and to supporting more able students and frequent non-attenders.
- Meetings of the entire subject department need to take place regularly to enable the sharing of strategies among peers; the agreement of departmental practices; and the building of bridges between junior and senior-cycle teaching approaches, to support even higher learner outcomes.
- The format of the literacy classes in first and second year needs to be revised, as per the advice given in the third section of this report.

Appendix XIII. UCS Sample Timetable

1st year



2nd Year



3rd year


Time
Monday
Tuesday
Wednesday
Thursday
Friday
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
Project Mathematics F48 Ms. E.Hickey 3PrjM-6.4 08:55 - 09:35
Coding G17 Ms. C. Carew 3Cod-7.1 09:35 - 10:15
Coding G17 Ms. C. Carew 3Cod-7.1 10:15 - 10:55
Materials Technology (Wood) G02 Mr. A. O'Connell 3MatT-2.4 11:10 - 11:50
Science (JC) G14 Ms. A. Waters 3Sci-A 11:50 - 12:30
Geography G18 Ms. L. McDonagh 3Geo-4.2 12:30 - 13:10
English G06 Ms. Erin Beaumont 3Eng-A 13:40 - 14:20
Technical Graphics G13 Mr. M O'Connor; Ms. Bernie O'Driscoll 3TG-5.1 14:20 - 15:00
Technical Graphics G13 Ms. Bernie O'Driscoll; Mr. M O'Connor 3TG-5.1 15:00 - 15:40
Business Studies G20 Ms. A. Nicholas 3Bus-A 08:55 - 09:35
English G06 Ms. Erin Beaumont 3Eng-A 09:35 - 10:15
Religious Education F43 Ms.Roisin O'Leary 3Rel-A 10:15 - 10:55
Technical Graphics G13 Ms. Bernie O'Driscoll; Mr. M O'Connor 3TG-5.1 11:10 - 11:50
Geography G18 Ms. L. McDonagh 3Geo-4.2 11:50 - 12:30
Irish F28 Ms. S. Ware 3Iri-3.5 12:30 - 13:10
French F38 Ms. S. Conway 3Fre-1.3 13:40 - 14:20
French F38 Ms. S. Conway 3Fre-1.3 14:20 - 15:00
Project Mathematics F48 Ms. E.Hickey 3PrjM-6.4 15:00 - 15:40
French F38 Ms. S. Conway 3Fre-1.3 08:55 - 09:35
English G06 Ms. Erin Beaumont 3Eng-A 09:35 - 10:15
Science (JC) G14 Ms. A. Waters 3Sci-A 10:15 - 10:55
Irish F28 Ms. S. Ware 3Iri-3.5 11:10 - 11:50
Project Mathematics F48 Ms. E.Hickey 3PrjM-6.4 11:50 - 12:30
Materials Technology (Wood) G02 Mr. A. O'Connell 3MatT-2.4 12:30 - 13:10
Student Voice G06 Ms. Erin Beaumont 3SV-A 13:40 - 14:20
Business Studies G20 Ms. A. Nicholas 3Bus-A 14:20 - 15:00
C.S.P.E G05 Ms. E. Brannan 3CSPE-A 15:00 - 15:40
Geography G18 Ms. L. McDonagh 3Geo-4.2 08:55 - 09:35
Project Mathematics F48 Ms. E.Hickey 3PrjM-6.4 09:35 - 10:15
Irish F28 Ms. S. Ware 3Iri-3.5 10:15 - 10:55
SPHE G09 Ms. Veronica Lavin 3SPHE-A 11:10 - 11:50
English G06 Ms. Erin Beaumont 3Eng-A 11:50 - 12:30
Materials Technology (Wood) G02 Mr. A. O'Connell 3MatT-2.4 13:00 - 13:40
Materials Technology (Wood) G02 Mr. A. O'Connell 3MatT-2.4 13:40 - 14:20
Physical Education PE1 Mr. T Heffernan 3PE-A 08:55 - 09:35
Physical Education PE1 Mr. T Heffernan 3PE-A 09:35 - 10:15
Religious Education F43 Ms.Roisin O'Leary 3Rel-A 10:15 - 10:55
French F38 Ms. S. Conway 3Fre-1.3 11:10 - 11:50
Science (JC) G14 Ms. A. Waters 3Sci-A 11:50 - 12:30
Technical Graphics G13 Ms. Bernie O'Driscoll; Mr. M O'Connor 3TG-5.1 12:30 - 13:10
Irish F28 Ms. S. Ware 3Iri-3.5 13:40 - 14:20
Business Studies G20 Ms. A. Nicholas 3Bus-A 14:20 - 15:00

Appendix IV. Fieldnotes

Field notes and images form UCS

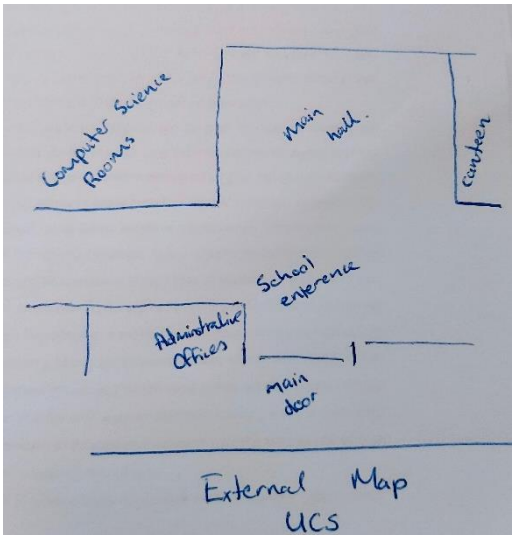


Figure 28 Map of UCS

Case notes

Figure 28 UCS Map provides a top-down view of the entrance to the school indicating where the computer science rooms are located in relation to the main hallway and the Administrative offices within the school.

Case notes

Figure 29 UCS CS Classroom is a top-down view of the Coding/Computer Science room within the school. This map was constructed during the school visit and is not to scale. However, it provides an indication of where various resources were located within the room. As can be seen, each of the students stations were equip with a mouse and keyboard. While the teacher desk and white board are located towards the front of the classroom. Storage was confined to the upper part of the room beside the teachers' desk.

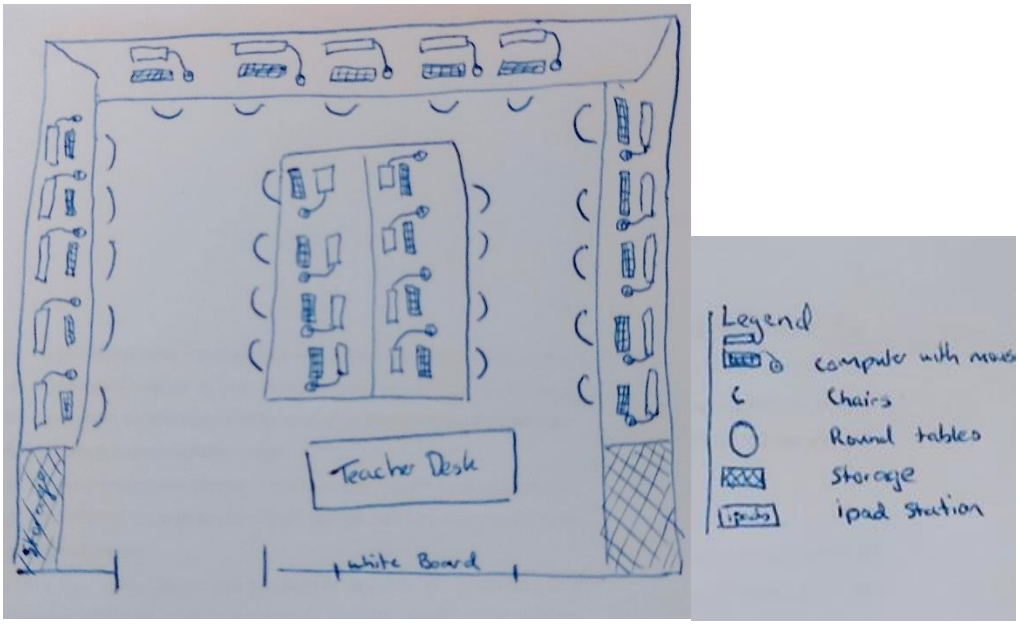


Figure 29 UCS CS Classroom

Field notes and images form RCS

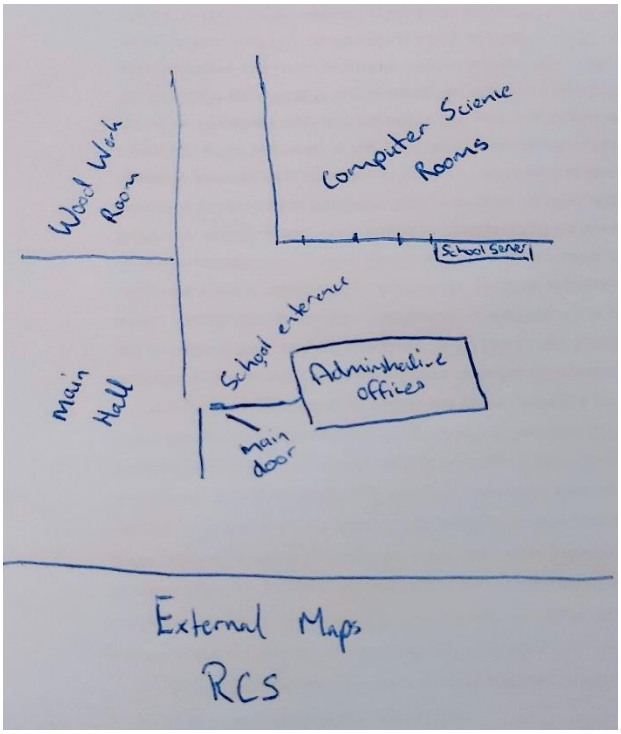


Figure 30 Map of RCS

Case notes

Figure 30 Map of RCS is a top-down view of the Coding/Computer Science room within the school. This map was constructed during the school visit and is not to scale. However, it provides an indication of where various resources were located within the room. As can be seen, each of the students stations were equip with a mouse and keyboard. While the teacher desk and white board are located towards the front of the classroom. Storage was confined to the upper part of the room beside the teachers' desk.

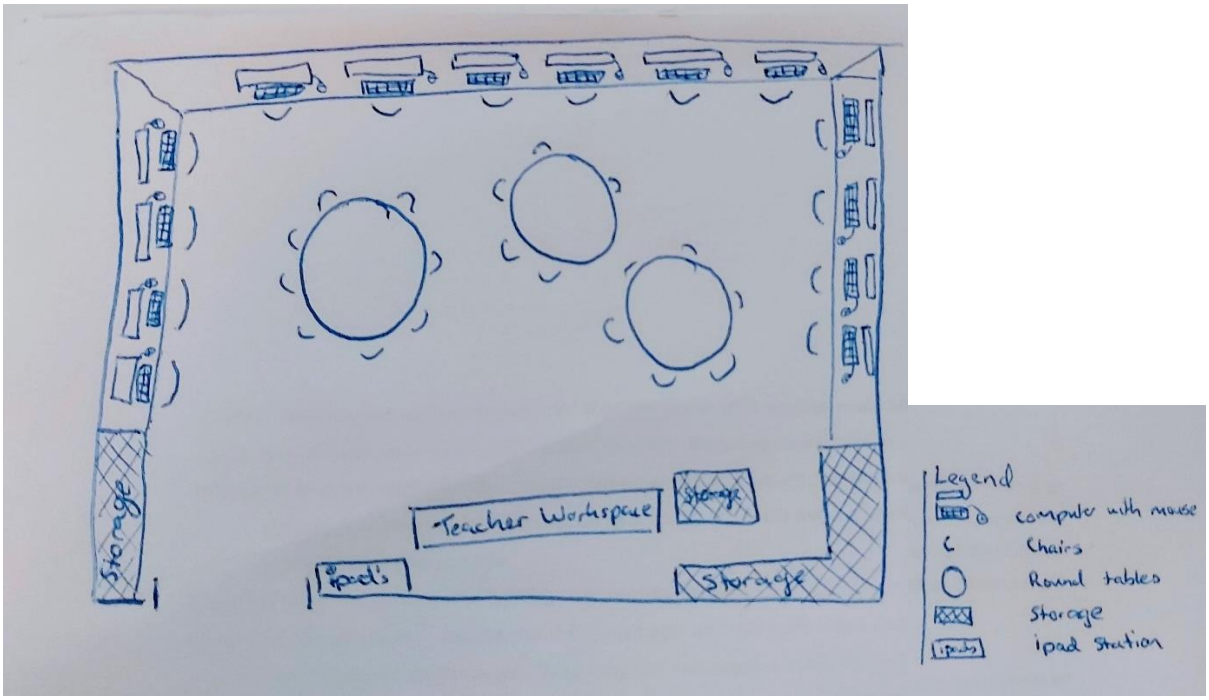


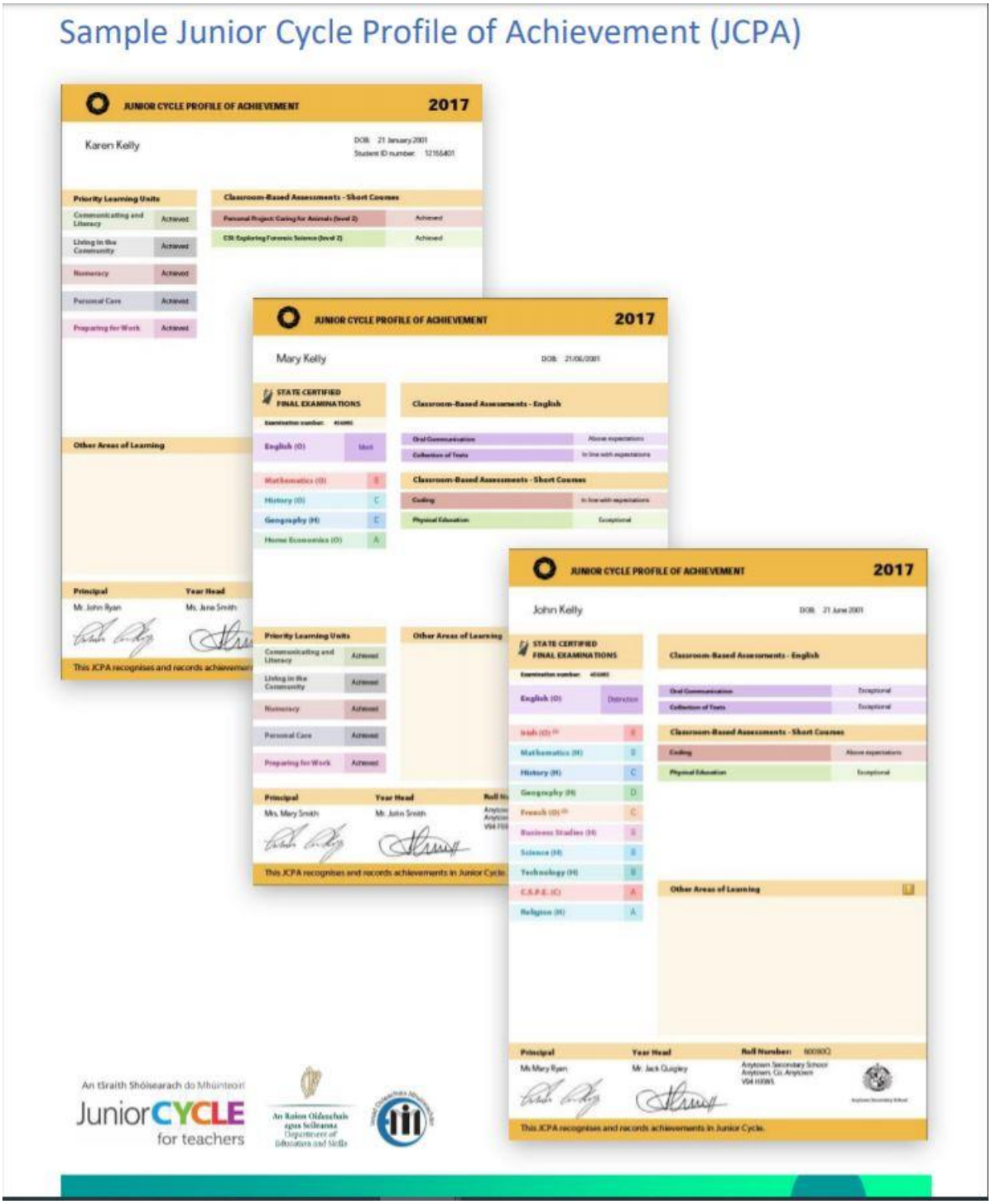
Figure 31RCS CS Classroom

Case notes

Figure 31 RCS CS Classroom is a top-down view of the Coding/Computer Science room within the school. This map was constructed during the school visit and is not to scale. However, it provides an indication of where various resources were located within the Coding classroom. As can be seen, each of the students stations were equip with a mouse and keyboard. While the teacher desk and white board are located towards the front of the classroom. Storage while extensive was confined to the upper part of the room beside the teachers' desk. As can be seen in photographs of the cables and resources such as ipads and microbits were carefully labeled and stored. These cabinets were also locked and Teacher C had the key.

In the center of the classroom there were three round tables, while each of these had pages, cables and students items on them when I was in the room, it was evident that they could still be moved with ease. The teacher informed me that these desks were useful for group projects or group instruction, they also provided space for unplugged activates and the expansion of CSE pedagogies and development of learning for both students and the teacher. As the teacher said, sometimes it is nice to take out a pen and paper and go through things with the students. At other times, these tables are used for robotics projects and even the development of cross-curricular projects.

Appendix V Junior Cycle Profile of Achievement



Appendix VI Terminology

Throughout this dissertation, various terms related to CSE were utilised; some of these are outlined below. However, it should be recognised that widely different uses of these and other terms arise in research and policy literature.

- Policy is a term which has a vast array of interpretations, often oversimplified; this study has chosen to align our definition with Ball, Maguire & Braun (2012) understanding of the term, to be a text and/ or artefacts, including but not limited to legislation, frameworks, assessment guidelines and specification documents. Ball et al. (2012), referred to these as 'complex configured, contextually mediated and institutionally rendered' (p. 3). He cautioned that within a policy, teachers are simultaneously the actors and objects; they are created for the idea of the school, which exists, in the 'fevered imaginings of politicians, civil servants, and advisors' (Ball et al., 2012, p. 3). In ROI, the National Council for Curriculum and Assessment (NCCA) and the Department of Education and Skills (DES), are responsible for the construction and approval of Education policy.

- The practice is the interpretation and translation of policy text to action within the specific socio-cultural context of a specific instance; it is ever-changing, case dependent and reliant on the resources available. The practice is the conscious and subconscious erosion and enactment of policy. As Bell, et al. (2014) contends it is 'sophisticated, contingent, complex and unstable' (p. 3).

- Enactment is used throughout this dissertation as the term which refers to the way in which policy is translated and interpreted in various settings where local factors, such as resources, and values are 'deployed in a complex and hybrid process' (Ball et al., 2012, p. 6).

- Programming & coding is defined as the act of creating computer code; in a script or language, which computers can understand (BitDegree Tutorials, 2020). Within this paper, when the author is referring to the short course, the term will appear as Coding. Coding is the name of the short

course and requires capitalisation, where coding appears it is referring to the action of coding, more information on the structure of the short course in Coding can be found in section 2.3.

- Technology/ Information and Communications Technology (ICT) are key terms, which hold distinctive meanings and have been utilised across government documents to refer to the physical, technological devices, infrastructure and online supports. Within the JC, students are encouraged to develop skills in eight key areas, within each of these students are encouraged to 'using digital technology' (Ireland. NCCA, 2014, p.7). ICT 'should be understood to mean the assembly, deployment, and configuration of digital systems to meet user needs for particular purposes' (Furber, 2012, P.17).

- Computer Science Education (CSE) is referred to numerous times within this dissertation. The primary aims of the short course in Coding are to allow students to learn about Computer Science. The definition set out by Webster 1996, who stated that: 'Computing includes not only the machines as artefacts but also the expertise and knowledge, culture and values of the computing profession, as well as… the production of hardware and software' (p.9). The above definition of CSE is utilised to cover all aspects of Computer Science instruction, including Coding as a subject area within the research dissertation.

The above terms are used throughout this document and fit within these definitions; it should also be noted that different uses of the above terms and other terms arise in research and policy literature. This can lead to difficulties ensuring the accuracy of communication of concepts, ideas and practice, and while every effort to ensure consistency and clarity of terms throughout this dissertation, some linguistic nuances may arise.